



Final Technical Report

Zonal Isolation Solution for Geothermal Wells

Award Recipient Organization:

University of Utah (DOE Project DE-EE0007080)

Subrecipient Organization:

PetroQuip

DUNS Identifier: 004174048

20520 Stokes Rd., Waller, TX 77484

Award Number: 1-2409

Project Period: 10/01/2021 – 12/31/2024

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Final Report for Zonal Isolation Solution for Geothermal Wells

PI: Robert Coon

1) Overview:

Our grant consisted of 2 major projects. The first was to develop a Locking Bridge Plug (LBP) that locked into a Landing Profile (LP) and held 7500 psi at 450°F. The second project was to create an Open Hole Packer (OHP) to isolate the individual sections of the casing from the reservoir.

The LBP Completed Milestones 1-4 and was successfully deployed and tested in Utah FORGE 6B well in April of 2024. The OHP completed Milestones 1-3 and was in the final testing to validate the tool when the project was finished.

2) Phase 1 – Task 1 - Development of 7-inch LBP and LP for either Cased or Open Hole

PetroQuip Energy Services (PQES) developed the LBP that isolates different internal sections (stages) of the casing by locking into the LPs that were previously installed as part of the casing. The system utilizing the LBP and the LP was designed to withstand pressure up to 7,500 psi (36 MPa) and temperatures up to 437° F (225° C).

Sub Task 1.1 – Complete the Engineering Design and Specifications Document (EDSD) for the LBP and LP – completed in Q1

Milestone 1.2 – Completed in Q2

Phase 1a Go/No-Go Decision Point – Approved Q2

Sub Task 1.2 – Design the LBP and LP – Completed in Q3

3) Phase 1- Task 2 - Development of 7-inch OHP

PQES developed a 7-inch OHP that isolates different external sections (stages) of the casing by sealing between the 7-inch casing and the 10-3/4-inch open hole. The OHP was designed to withstand a differential pressure of 7,500 psi (36 MPA) and temperatures up to 437°F (225°C).

Sub Task 2.1 – Define parameters and functionality of the OHP – completed in Q1

Milestone 2.2 – Completed in Q2

Phase 1b Go/No-Go Decision Point – Approved Q2

Sub Task 2.2 – Design the OHP – Completed in Q3

4) Phase 2 -Task 3 – Manufacturing, Testing Prep, and Testing

Manufactured all the tools, test fixtures, and replacement parts to test the tools to the parameters in the EDSD. In this phase, we created test procedures, held safety reviews, and reviewed all testing with our third-party testing company before we started testing.

Sub Task 3.1 – Design the test fixtures for both the LBP and the OHP – Completed Q4

Sub Task 3.2 – Manufacture the test fixtures – Completed Q4

Sub Task 3.3 – Upgrade software and hardware in the test cell – Completed Q4

Sub Task 3.4 – Manufacture the LBP/LP and the OHP – Completed Q5

Milestone 3 – Submit documents showing the manufacturing of tools and fixtures - Completed in Q6

Sub Task 4.1 – Validate the design of the LBP/LP by testing – Completed Q10

Sub Task 4.2 – Design iterations of the LBP/LP – Completed Q10

Sub Task 4.3 and 4.4 – Testing and design iterations of the OHP – Not Completed

Milestone 4 – Submit all testing on the LBP/LP and the OHP – Completed Q10

Phase 2 – Go-No-Go – Testing complete and approved for running the LBP-LP into the test well - Completed Q9

Chart of all test results

Test #	Date	Description	Results
1	Dec-22	Set the LBP into the LP	Leak at the ball seat on the RT
2	Dec-22	Pressure Test at Amb and 450°F	Successful
3	Jan-23	Set the LBP into the LP	Fixture Damage, Leak
4	Mar-23	Set the LBP into the LP	Ball seat Leak
5	Apr-23	Pressure Test LBP previously set in the LP	Leak in an O-ring on the LBP
6	Apr-23	Pressure Test LBP previously set in the LP	Successful
7	May-23	OHP Set and Pressure Test	Fixture Issues
8	May-23	OHP body pressure test	Successful
9	May-23	Pressure Test new O-ring for LBP	Successful
10	May-23	Pressure Test LBP previously set in the LP (new O-ring)	Successful
11	Jun-23	OHP Set and Pressure Test	Internal Seal Leaking
12	Jun-23	Set the LBP into the LP and pressure test	RT didn't shear properly
13	Jun-23	OHP Set and Pressure Test	Packer Set properly but leaked
14	Jun-23	Set the LBP into the LP and pressure test	LBP set properly, but leaked (shear Pin ends)
15	Oct-23	Set the LBP into the LP and pressure test	RT didn't function properly after setting the LBP
16	23-Aug	OHP Set and Pressure Test	Fixture Issue didn't heat up fixture
17	Aug-23	OHP Set and Pressure Test	Packer Set properly but leaked
18	Nov-23	Set the LBP into the LP and pressure test	Fixture Issues, no test
19	23-Nov	OHP Set and Pressure Test	Fixture Issues, no test
20	Dec-23	Set the LBP into the LP and pressure test	RT didn't function properly after setting the LBP
21	24-Jan	Set OHP in Short Casing at Temp	Not pressure tested, just to view element system
22	Feb-24	OHP Set and Pressure Test	Element held pressure, but internal seals leaked
23	Feb-24	Set the LBP into the LP and pressure test	Successful
24	Mar-24	OHP Set and Pressure Test	Element held pressure, but internal seals leaked

5) Phase 3 -Task 5 – Inhouse Integration Testing of the LBP

All Integration testing of the LBP/LP was performed in Task 4. Task 5 was eliminated because it was incorporated into the testing in Task 4.

Phase 3 – Go-No-Go – Completed Q9 by Phase 2 Go-No-Go

6) Phase 4 – Task 7 – Field Installation Testing (FIT) of the LBP

All testing has been approved and the LBP was installed in well 6b.

Sub Task 7.1 – Define the FIT – Completed Q9

Sub Task 7.2 – Manufacture all Components for the FIT – Completed Q9

Sub Task 7.3 – Perform a Factory Acceptance Test on all Components – Completed Q9

Phase 4 – Go-No-Go for Field Installation – Completed Q9

Sub Task 7.4 – Transport all components to the Field – Completed Q9

Sub Task 7.5 – Install the LBP in test well 6B – Completed Q10

Sub Task 7.6 – Evaluate the FIT – Completed Q10

Conclusion:

PQES has developed a system that can reliably be used for isolation during simulation with the Locking Bridge Plug and the corresponding Landing Profile. During testing it held 7,500 psi at 450°F repeatedly and maintained the pressure differential down to ambient. When it was installed in 6B the LBP passed the test at 7,500 psi. After 9 days landed in the LP the LBP no longer held the 7,500 psi. While retrieving the LBP a restriction was encountered and the LBP was left downhole. Once all operations were complete on 6B the LBP was milled with the remaining frac plugs. At the end of this document in Attachment A – Job Log from the Installation on 6B.

The OHP held pressure from each direction but failed when cooled down. All investigations after the final test show that the internal seals on the setting pistons were leaking causing the failure of the test.

We believe we have added to the newly developing technology of EGS with both products.

Attachment A – Job Log from Installation on 6B

Operator:	Utah FORGE	Base Point:	Waller, Texas
Company Rep:	Leroy Swearingen	Superior Rep:	Bobby Wojciechowski
Well Name:	16B(78)-32	Date Started:	3/24/2024
US Job #	0	Date Completed:	1/0/1900
County/State:	Beaver, Utah	Type of Job:	Bridge Plug/Frac

DETAILS OF JOB - THIS FORM USED TO REPORT WHAT ACTUALLY TOOK PLACE - FILL OUT COMPLETELY

DATE	TIME	Description
3/22/24	21:15	Arrive in Las Vegas from Houston and get rental to drive to Beaver, Utah
3/23/24		Arrive at hotel in Beaver
3/24/24	8:15	Arrive on location at FORGE well site and do a visual on tools shipped from Houston. Discussed with Leroy (company man) if they ran a gage to the top of the no-go in the nipple and no gage run was run prior to the brush. The call was to use the collar locator tool and tag the top of the no-go in the nipple.
3/25/24	6:00	While RIH 500' above the nipple weight dropped off and the driller P/U and went back down. While RIH 500' above the nipple weight dropped off and the driller P/U and went back down with no issues. There is debris building up below brush due to scale. Once we got to nipple the brush was reciprocated 5 times before the locator landed. Located one time and lost 14K and P/U. During the second attempt to land the locator passed through. We decided to POOH and at 3 STDS out the driller encountered a 40K overpull. When the collar locator was in the BOP's one of the dog segments were cracked and hung up in the BOP. A magnet was used to try and fish the dog out but it fell IH. The plan was to get a 5.25 magnet from Vernal and fish the fragments. All parts were recovered with the exception of bow springs. R/U and RIH with brush and run through nipple and push bow springs from locator left IH.
3/26/24	06:00	RIH and POOH. P/U 5.75 gauge and RIH to no-go in the nipple. Still POOH with 5.75 gauge
3/27/24	3:30	P/U and M/U Bridge Plug to centralizer pup jnt and the other 2 pup jnts
	6:15	All BHA is IH and RIH with 3-1/2 STDS
	7:00	P/U STD 116 and M/U to string. Landed in slips and B/O top of STD to M/U Pumping accessories
	11:40	Drop ball
	12:03	Pumping .5-1 bbls/min and 8-10 total bbls pumped to seat ball with 1300 psi
	12:30	Slack off to mark on top of STD 116 with 7' stick up
	12:35	Set down 15K on No-Go
	12:37	Increase pressure to 3100 psi to set BP. Tried 3 attempts to release from BP with 30K overpull
	12:40	74K was the P/U weight, 104K no shear release from Running tool
	12:45	Pressure back to 3100 psi down tubing and over pulled with 6K to release running tool from BP
	12:50	POOH 15'
	12:51	Attempted to blow ballseat in Runnign Tool at 3500 psi with no success. Increased pressure to 4800 psi
	12:52	Ballseat blown at 4800 psi
	13:00	Close rams and pressure up on BP to 3000 psi for 5 minutes
	13:05	5 minute hold completed
	13:12	Continue to POOH
	13:50	Still POOH with 1061' left to rack back.
	18:05	Running tool is out and filled hole and closed rams
	19:07	Pressure up to 7280 with cement unit to see if the pressure would increase due to temp affect
	19:10	No significant pressure increase from BHT so we pressured up to 7500psi and held for 10 minutes
	19:29	Finished hold and bled well back to 0
	19:41	Packed up equipment and went back to hotel



Operator:	Utah FORGE	Base Point:	Waller, Texas
Company Rep:	Leroy Swearingen	Superior Rep:	Bobby Wojciechowski
Well Name:	16B(78)-32	Date Started:	3/24/2024
US Job #	0	Date Completed:	1/0/1900
County/State:	Beaver, Utah	Type of Job:	Bridge Plug/Frac
DATE	TIME	Description	
4/5/24	8:00	Arrived at location and waited on frac to finish so I can attempted to pressure up on BP. The Static pressure on 16B was 2400 psi	
	10:15	Pressured up to 4,800 psi with rig pumps, watched pressure decrease to 3100 psi in 3-4 minute and bled back to 1300 psi at manifold.	
	10:59	Continued pressure up and bleed back 4 times with no success	
	11:05	Began to pressure up to 4800 psi and let pressure bleed down on its own to 3100 psi	
	11:54	Attempted 6 times to pressure up to 4800 psi and bled down on its own to 3100 psi 6 time with sign the pressure was stabilizing .	
	12:05	Called it a day and would wait to pull the BP on Sunday	
4/6/24	23:50	Picked up pulling tool and checked all set screws	
	23:53	P/U Pulling tool, perforated pup to allow the tubing to fill and circulate above Pulling tool if need be. The first centralizer pup jnt was full of black tar like material and took 15 minutes to remove. Added the 3 centralizer pup jnts to BHA and began RIH	
4/7/24	5:20	Got P/U weight 66K S/O weight 50K and Hanging weight 54K at 9684'	
	6:30	Latched into BP with 15000 lbs down and picked up. Saw a 1000 lbs over pull on string at 9874	
	6:35	Racked back 1 full STD and on the 2 full stand took 8K over pull at 9752. Attempted to work the string twice and both times pulling 20K over with no success	
	6:45	S/O and broke out jnt and M/U pump in sub. Will circulate bottoms up at 3-5 bbls/min	
	6:52	Began circulating and will need 214 bbls for bottoms up	
	7:45	Shut pumps off and rigged down pumping equipment	
	7:50	M/U jnt to string in rotary and POOH	
	7:52	Took over pull again at 9752 and tried 2 with 20K. On 3rd attempt at 30K string passed through and did not want to go back down	
	12:15	OOH with running tool but no BP. There was a peek chevron that was 36' up on the centralizer pup jnt.	
	13:30	Run back in with the back up pulling tool to try to retrieve BP	
	16:30	Got P/U weight 70K, S/O weight 58K and hanging weight 62K at 9684'	
	16:40	Tagged BP at same spot with 5K. Did not engage with profile. Set down 10K and still nothing. Set down 20K and plug moved down.	
	16:45	Continue to RIH and push the BP below nipple	
	16:51	Tagged nipple with BP at 9874 with 8-10K and began to POOH	



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US Job #	0	Date Completed:	1/0/1900
County/State:	Beaver, Utah	Type of Job:	Bridge Plug/Frac
DATE	TIME	Description	
4/7/24	17:01	Never saw any over pull at 9752 where BP was hanging up.	
	20:46	Pulling tool OOH and collet had damage to half of the fingers, No Bridge Plug.	
	21:02	Laid down all components of BHA and began packing all tools on pallets.	
	22:00	Left location and headed back to hotel.	

1-2409_PetroQuip Energy Services - 2022 Technical Report

PetroQuip's Geothermal Isolation System

1. Zonal Isolation Solution for Geothermal Wells/1-2409

- Organization: PetroQuip Energy Services, Waller, Texas
- Principal Investigator: Robert Coon, VP of Operations
- PI's Email: rcoon@petroquip.com
- Subcontractor: Mechanical Testing Services (MTS), Waller, Texas
- Project Start and End Date: 10/01/2021 -09/30/2024

2. Project Objectives and Purpose

PetroQuip PetroQuip Energy Services proposed the design and development of a multi-stage system that functions in a high-temperature environment of a UtahFORGE geothermal well. The tools consist of an Open-Hole Packer (OHP), a Locking Bridge Plug (LBP), and a corresponding Locating Profile (LP).

Locking Bridge Plug (LBP) and Locating Profile (LP)

The LBP is run in hole (RIH) and locates/ locks into the LP that was previously installed as part of the casing string.

- This combination removes most of the issues with a traditional bridge plug set in the casing.
 - Chevron-style seal assemblies provide better sealability than expanded rubber elements of a traditional bridge plug.
 - Locking into the LP provides a positive attachment to the casing compared to a traditional bridge plug that could damage the casing and release when pressure is applied.
- The polished bore and profile of the LP will stay in the well to allow further isolation during the life of the well.
- As technologies are developed the LP will provide locations to deploy alternative equipment.

Open-hole Packer (OHP)

The OHP isolates the OD of the casing to the ID of the downhole formation.

- Utilizes a long element system designed to work in high-temperatures of geothermal wells.
- Dual setting pistons compress the element system as pressure is applied, maximizing contact area.

3. Technical Barriers and Targets

Locking Bridge Plug(LBP) and Locating Profile (LP)

- Traditionally it is hard to set an isolation device like a bridge plug or frac plug in 7" casing while maintaining a pressure differential of 7,000 psi at 450°F. Once it has completed this isolation it then needs to be easily retrieved or removed. The LBP addresses these issues by using an LP to locate and seal with high-temperature non-elastomeric chevron seals without damaging the ID of the casing.

Open-Hole Packer (OHP)

- An industry standard open-hole packer has trouble sealing and maintaining the seal at 450°F. Our OHP addresses this problem by using non-elastomeric internal seals and a heavy-duty 6-piece backup system to support the 4-piece FKM element system.

Targets for the next year:

- The individual tools will be tested to UtahFORGE well environment.
- All tools will be tested together in a System Integration Test (SIT), following the individual testing.

4. Technical Approach

- Our Technical approach is to create a document called an Engineering Design Specification Document (EDSD) that contains the application, specifications, testing, materials, and running procedures. We then follow the methodology of multiple design reviews working through all manufacturing, assembly, testing, and running contingencies before creating manufacturing drawings.
- All testing is done on the individual components and then on the whole system. All qualification testing is done to the well environment of UtahFORGE.
- Key issues of the LBP/LP are:
 - Extreme Temperatures – All seals are non-elastomeric premium seal stacks
 - Reliability – by utilizing the LP we have increased the reliability of setting and sealing over a traditional bridge plug
 - Selectibility – Ability to set in any LP in the casing string
 - Retrievalability – Ease of retrieving over a traditional bridge plug

5. Project Timeline (list milestones achieved and/or decision points)

- Milestone 1.1 – Complete the EDSD for the LBP/LP– Q1 completed
- Milestone 1.2 – Submit Final Design Review – Q2 completed
- Milestone 2.1 – Complete the EDSD for the OHP – Q2 completed
- Milestone 2.2 - Submit Final Design Review – Q2 completed
- Phase 1 Go-No-GO – Q3 Approved by UtahFORGE

6. Technical Accomplishments

- Our design of both the LBP and the OHP will help move the Geothermal market along because of the following technological advancements;
 - By utilizing the Landing Profile (LP) we can provide a means of locating other isolation methods and well controls after it is used for the LBP.
 - High-Temperature non-elastomeric seals.
 - Heavy Duty element backup system to contain the long 4-piece FKM element system on the OHP.

7. Challenges to Date

- Our biggest challenge to date was that we underestimated the time to fully evaluate the design. The step from conceptual design to creating manufacturing drawings took 3 months longer than originally planned. We believe this time was well spent since it addressed possible issues during the installation and lifespan of the downhole tools. This extra time spent early in the design phase should make the testing phase less problematic and minimize any design iterations during testing.

8. Conclusion and Plans for the Future

- We have deviated from the schedule by 3 months spending more time upfront in the design phase. This extra time was used to simplify the LBP and review running procedures. This extra time taken for the reviews, calculations, and detailing of the prints should minimize the iterations that might come during testing.
 - The advantages of our system are as follows:
 - By utilizing Landing Profiles (LP) in the casing string we can provide a permanent and reliable means of setting Bridge Plugs. Since the LP is permanent it can be used for the life of the well to locate and land other down-hole equipment.
 - The Locking Bridge Plug (LBP) setting in an LP is fundamentally easier to set and retrieve than a traditional Bridge Plug.
 - The OHP creates a seal against cylindrical and irregular open-holes by employing a long, four-piece elastomer element supported by a robust, six-piece backup system comprised of multiple materials.

- All chevron seals are non-elastomeric to ensure long life at 450°F
 - Dual opposing pistons ensure that the long element system is completely set.
 - All components will be tested at 450°F individually and as a system, before they are taken to the UtahFORGE site.
- We will spend the next year testing the individual components, then testing the whole system at our facility to the temperature and pressures specified in the EDSO. The following year we will deploy the system in the UtahFORGE's test well. Our current team is very capable of achieving these goals over the next year.

9. Geothermal Data Repository

- List uploads to the Geothermal Data Repository (<http://gdr.openei.org/>):
 - EDSO of the Locking Bridge Plug (LBR) and the Locating Profile (LP) has already been uploaded
 - EDSO of the Open-Hole Packer (OHP) has already been uploaded
 - All test reports will be uploaded as each test is performed

10. Publications and Presentations, Intellectual Property (IP), Licenses, etc.

- We have a PetroQuip Geothermal presentation that we have given to 2 geothermal companies. It highlights the benefits of the system we are developing for UtahFORGE. A copy was sent to Greg Nash for him to use any of it he needed for the Wiki page.

11. Publicity and outreach (Optional)

- We have already posted one LinkedIn post right after we completed the Go-No-Go design review. We will continue to post as we assemble and test.

1-2409_PetroQuip Energy Services - 2023 Technical Report

PetroQuip's Geothermal Isolation System

1. Zonal Isolation Solution for Geothermal Wells/1-2409

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- Principal Investigator: Robert Coon, VP of Operations
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- As technologies are developed the LP will provide locations to deploy alternative equipment.

Open-hole Packer (OHP)

The OHP isolates the OD of the casing to the ID of the downhole formation.

- Utilizes a long element system designed to work in high-temperatures of geothermal wells.
- Dual-setting pistons compress the element system as pressure is applied, maximizing contact area.

3. Technical Barriers and Targets

Locking Bridge Plug(LBP) and Locating Profile (LP)

- Traditionally it is hard to set an isolation device like a bridge plug or frac plug in 7" casing while maintaining a pressure differential of 7,000 psi at 450°F. Once it has completed this isolation it then needs to be easily retrieved or removed. The LBP addresses these issues by using an LP to locate and seal with high-temperature non-elastomeric chevron seals without damaging the ID of the casing.

Open-Hole Packer (OHP)

- An industry-standard open-hole packer has trouble sealing and maintaining the seal at 450°F. Our OHP addresses this problem by using non-elastomeric internal seals and a heavy-duty 6-piece backup system to support the 4-piece FKM element system.

Targets for the next year:

- The individual tools will be tested in the UtahFORGE well environment.
- All tools will be tested together in a System Integration Test (SIT), following the individual testing.

4. Technical Approach

- Our Technical approach is to create a document called an Engineering Design Specification Document (EDSD) that contains the application, specifications, testing, materials, and running procedures. We then follow the methodology of multiple design reviews working through all manufacturing, assembly, testing, and running contingencies before creating manufacturing drawings.
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- Milestone 2.2 - Submit Final Design Review – Q2 completed
- Phase 1 Go-No-GO – Q3 Approved by UtahFORGE
- Milestone 3.0 – Submit doc showing completion of tools and fixtures – Q6 completed

6. Technical Accomplishments

- Our design of both the LBP and the OHP will help move the Geothermal market along because of the following technological advancements;
 - By utilizing the Landing Profile (LP) we can provide a means of locating other isolation methods and well controls after it is used for the LBP.
 - High-temperature non-elastomeric seals.
 - Heavy Duty element backup system to contain the long 4-piece FEPM element system on the OHP.

7. Challenges to Date

- Our biggest challenge to date was that we underestimated the time to fully evaluate the design. The step from conceptual design to creating manufacturing drawings took 3 months longer than originally planned. We believe this time was well spent since it addressed possible issues during the installation and lifespan of the downhole tools. This extra time spent early in the design phase should make the testing phase less problematic and minimize any design iterations during testing.
- The second biggest challenge was the element system on the OHP. We need to incorporate a backup system on the center of the element to hold the rubber in place to create a reliable seal. This is being done in Q8. The OHP has held the required pressure and temperature but isn't reliable enough without the center backups on the element.

8. Conclusion and Plans for the Future

- We have spent the last year creating a means to test at 450°F with water safely. During this testing, we have proven the LBP/LP to the requirements in the SOPO. We will continue to test it to increase its reliability before running it in the Utah FORGE test well.
- The OHP has functioned properly and set the large element system properly. At temperature, the element needs more backup. A Backup for a rubber element system is a means of holding it in place to create the seal. We have contained on the ends but not in the center. The thought, when it was designed, was that the 2 elements would contain each other as they approached the center. This was not the case, therefore it needs the same backup as the ends.

- Once this is accomplished the OHP will be ready for a field trial at Utah FORGE.

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- List uploads to the Geothermal Data Repository (<http://gdr.openet.org/>):
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11. Publicity and outreach (Optional)

- We have already posted five LinkedIn posts this last year. We are also featured in a Journal of Petroleum Technology article (with John McLennan) highlighting the work done at Utah FORGE and Geothermal.

1-2409_PetroQuip Energy Services - 2024 Technical Report and
End of Project Report

End of Project Report

Organization: University of Utah

Recipient Organization: PetroQuip
DUNS Number: 004174048
Recipient Address: 20520 Stokes Rd.
Waller, TX 77484

Award Number: 1-2409
Project Title: Zonal Isolation Solution for Geothermal Wells

Project Period: 10/01/2021 – 09/30/2024

Principal Investigator: Robert Coon
VP Operations, PetroQuip
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936-931-0100

Report Submitted by: Robert Coon

Date of Report Submission: 1/19/2024
Reporting Period: 12/31/2023-3/31/2024

Project Partners: none

Topic Leads: Ben Barker, Utah FORGE
Bill Vandemeer, DOE-GTO
George Stutz, DOE-GTO

Final Report for Zonal Isolation Solution for Geothermal Wells

PI: Robert Coon

1) Overview:

Our grant consisted of 2 major projects. The first was to develop a Locking Bridge Plug (LBP) that locked into a Landing Profile (LP) and held 7500 psi at 450°F. The second project was to create an Open Hole Packer (OHP) to isolate the individual sections of the casing from the reservoir.

The LBP Completed Milestones 1-4 and was successfully deployed and tested in Utah FORGE 6B well in April of 2024. The OHP completed Milestones 1-3 and was in the final testing to validate the tool when the project was finished.

2) Phase 1 – Task 1 - Development of 7-inch LBP and LP for either Cased or Open Hole

PetroQuip Energy Services (PQES) developed the LBP that isolates different internal sections (stages) of the casing by locking into the LPs that were previously installed as part of the casing. The system utilizing the LBP and the LP was designed to withstand pressure up to 7,500 psi (36 MPa) and temperatures up to 437° F (225° C).

Sub Task 1.1 – Complete the Engineering Design and Specifications Document (EDSD) for the LBP and LP – completed in Q1

Milestone 1.2 – Completed in Q2

Phase 1a Go/No-Go Decision Point – Approved Q2

Sub Task 1.2 – Design the LBP and LP – Completed in Q3

3) Phase 1- Task 2 - Development of 7-inch OHP

PQES developed a 7-inch OHP that isolates different external sections (stages) of the casing by sealing between the 7-inch casing and the 10-3/4-inch open hole. The OHP was designed to withstand a differential pressure of 7,500 psi (36 MPa) and temperatures up to 437°F (225°C).

Sub Task 2.1 – Define parameters and functionality of the OHP – completed in Q1

Milestone 2.2 – Completed in Q2

Phase 1b Go/No-Go Decision Point – Approved Q2

Sub Task 2.2 – Design the OHP – Completed in Q3

4) Phase 2 -Task 3 – Manufacturing, Testing Prep, and Testing

Manufactured all the tools, test fixtures, and replacement parts to test the tools to the parameters in the EDSD. In this phase, we created test procedures, held safety reviews, and reviewed all testing with our third-party testing company before we started testing.

Sub Task 3.1 – Design the test fixtures for both the LBP and the OHP – Completed Q4

Sub Task 3.2 – Manufacture the test fixtures – Completed Q4

Sub Task 3.3 – Upgrade software and hardware in the test cell – Completed Q4

Sub Task 3.4 – Manufacture the LBP/LP and the OHP – Completed Q5

Milestone 3 – Submit documents showing the manufacturing of tools and fixtures - Completed in Q6

Sub Task 4.1 – Validate the design of the LBP/LP by testing – Completed Q10

Sub Task 4.2 – Design iterations of the LBP/LP – Completed Q10

Sub Task 4.3 and 4.4 – Testing and design iterations of the OHP – Not Completed

Milestone 4 – Submit all testing on the LBP/LP and the OHP – Completed Q10

Phase 2 – Go-No-Go – Testing complete and approved for running the LBP-LP into the test well - Completed Q9

Chart of all test results

Test #	Date	Description	Results
1	Dec-22	Set the LBP into the LP	Leak at the ball seat on the RT
2	Dec-22	Pressure Test at Amb and 450°F	Successful
3	Jan-23	Set the LBP into the LP	Fixture Damage, Leak
4	Mar-23	Set the LBP into the LP	Ball seat Leak
5	Apr-23	Pressure Test LBP previously set in the LP	Leak in an O-ring on the LBP
6	Apr-23	Pressure Test LBP previously set in the LP	Successful
7	May-23	OHP Set and Pressure Test	Fixture Issues
8	May-23	OHP body pressure test	Successful
9	May-23	Pressure Test new O-ring for LBP	Successful
10	May-23	Pressure Test LBP previously set in the LP (new O-ring)	Successful
11	Jun-23	OHP Set and Pressure Test	Internal Seal Leaking
12	Jun-23	Set the LBP into the LP and pressure test	RT didn't shear properly
13	Jun-23	OHP Set and Pressure Test	Packer Set properly but leaked
14	Jun-23	Set the LBP into the LP and pressure test	LBP set properly, but leaked (shear Pin ends)
15	Oct-23	Set the LBP into the LP and pressure test	RT didn't function properly after setting the LBP
16	23-Aug	OHP Set and Pressure Test	Fixture Issue didn't heat up fixture
17	Aug-23	OHP Set and Pressure Test	Packer Set properly but leaked
18	Nov-23	Set the LBP into the LP and pressure test	Fixture Issues, no test
19	23-Nov	OHP Set and Pressure Test	Fixture Issues, no test
20	Dec-23	Set the LBP into the LP and pressure test	RT didn't function properly after setting the LBP
21	24-Jan	Set OHP in Short Casing at Temp	Not pressure tested, just to view element system
22	Feb-24	OHP Set and Pressure Test	Element held pressure, but internal seals leaked
23	Feb-24	Set the LBP into the LP and pressure test	Successful
24	Mar-24	OHP Set and Pressure Test	Element held pressure, but internal seals leaked

5) Phase 3 -Task 5 – Inhouse Integration Testing of the LBP

All Integration testing of the LBP/LP was performed in Task 4. Task 5 was eliminated because it was incorporated into the testing in Task 4.

Phase 3 – Go-No-Go – Completed Q9 by Phase 2 Go-No-Go

6) Phase 4 – Task 7 – Field Installation Testing (FIT) of the LBP

All testing has been approved and the LBP was installed in well 6b.

Sub Task 7.1 – Define the FIT – Completed Q9

Sub Task 7.2 – Manufacture all Components for the FIT – Completed Q9

Sub Task 7.3 – Perform a Factory Acceptance Test on all Components – Completed Q9

Phase 4 – Go-No-Go for Field Installation – Completed Q9

Sub Task 7.4 – Transport all components to the Field – Completed Q9

Sub Task 7.5 – Install the LBP in test well 6B – Completed Q10

Sub Task 7.6 – Evaluate the FIT – Completed Q10

Conclusion:

PQES has developed a system that can reliably be used for isolation during simulation with the Locking Bridge Plug and the corresponding Landing Profile. During testing it held 7,500 psi at 450°F repeatedly and maintained the pressure differential down to ambient. When it was installed in 6B the LBP passed the test at 7,500 psi. After 9 days landed in the LP the LBP no longer held the 7,500 psi. While retrieving the LBP a restriction was encountered and the LBP was left downhole. Once all operations were complete on 6B the LBP was milled with the remaining frac plugs. At the end of this document in Attachment A – Job Log from the Installation on 6B.

The OHP held pressure from each direction but failed when cooled down. All investigations after the final test show that the internal seals on the setting pistons were leaking causing the failure of the test.

We believe we have added to the newly developing technology of EGS with both products.

Attachment A – Job Log from Installation on 6B



Operator:	Utah FORGE	Base Point:	Waller, Texas
Company Rep:	Leroy Swearingen	Superior Rep:	Bobby Wojciechowski
Well Name:	16B(78)-32	Date Started:	3/24/2024
US Job #	0	Date Completed:	1/0/1900
County/State:	Beaver, Utah	Type of Job:	Bridge Plug/Frac

DETAILS OF JOB - THIS FORM USED TO REPORT WHAT ACTUALLY TOOK PLACE - FILL OUT COMPLETELY

DATE	TIME	Description
3/22/24	21:15	Arrive in Las Vegas from Houston and get rental to drive to Beaver, Utah
3/23/24		Arrive at hotel in Beaver
3/24/24	8:15	Arrive on location at FORGE well site and do a visual on tools shipped from Houston. Discussed with Leroy (company man) if they ran a gage to the top of the no-go in the nipple and no gage run was run prior to the brush. The call was to use the collar locator tool and tag the top of the no-go in the nipple.
3/25/24	6:00	While RIH 500' above the nipple weight dropped off and the driller P/U and went back down. While RIH 500' above the nipple weight dropped off and the driller P/U and went back down with no issues. There is debris building up below brush due to scale. Once we got to nipple the brush was reciprocated 5 times before the locator landed. Located one time and lost 14K and P/U. During the second attempt to land the locator passed through. We decided to POOH and at 3 STDS out the driller encountered a 40K overpull. When the collar locator was in the BOP's one of the dog segments were cracked and hung up in the BOP. A magnet was used to try and fish the dog out but it fell IH. The plan was to get a 5.25 magnet from Vernal and fish the fragments. All parts were recovered with the exception of bow springs. R/U and RIH with brush and run through nipple and push bow springs from locator left IH.
3/26/24	06:00	RIH and POOH. P/U 5.75 gauge and RIH to no-go in the nipple. Still POOH with 5.75 gauge
3/27/24	3:30	P/U and M/U Bridge Plug to centralizer pup jnt and the other 2 pup jnts
	6:15	All BHA is IH and RIH with 3-1/2 STDS
	7:00	P/U STD 116 and M/U to string. Landed in slips and B/O top of STD to M/U Pumping accessories
	11:40	Drop ball
	12:03	Pumping .5-1 bbls/min and 8-10 total bbls pumped to seat ball with 1300 psi
	12:30	Slack off to mark on top of STD 116 with 7' stick up
	12:35	Set down 15K on No-Go
	12:37	Increase pressure to 3100 psi to set BP. Tried 3 attempts to release from BP with 30K overpull
	12:40	74K was the P/U weight, 104K no shear release from Running tool
	12:45	Pressure back to 3100 psi down tubing and over pulled with 6K to release running tool from BP
	12:50	POOH 15'
	12:51	Attempted to blow ballseat in Running Tool at 3500 psi with no success. Increased pressure to 4800 psi
	12:52	Ballseat blown at 4800 psi
	13:00	Close rams and pressure up on BP to 3000 psi for 5 minutes
	13:05	5 minute hold completed
	13:12	Continue to POOH
	13:50	Still POOH with 1061' left to rack back.
	18:05	Running tool is out and filled hole and closed rams
	19:07	Pressure up to 7280 with cement unit to see if the pressure would increase due to temp affect
	19:10	No significant pressure increase from BHT so we pressured up to 7500psi and held for 10 minutes
	19:29	Finished hold and bled well back to 0
	19:41	Packed up equipment and went back to hotel



Operator:	Utah FORGE	Base Point:	Waller, Texas
Company Rep:	Leroy Swearingen	Superior Rep:	Bobby Wojciechowski
Well Name:	16B(78)-32	Date Started:	3/24/2024
US Job #	0	Date Completed:	1/0/1900
County/State:	Beaver, Utah	Type of Job:	Bridge Plug/Frac
DATE	TIME	Description	
4/5/24	8:00	Arrived at location and waited on frac to finish so I can attempted to pressure up on BP. The Static pressure on 16B was 2400 psi	
	10:15	Pressured up to 4,800 psi with rig pumps, watched pressure decrease to 3100 psi in 3-4 minute and bled back to 1300 psi at manifold.	
	10:59	Continued pressure up and bleed back 4 times with no success	
	11:05	Began to pressure up to 4800 psi and let pressure bleed down on its own to 3100 psi	
	11:54	Attempted 6 times to pressure up to 4800 psi and bled down on its own to 3100 psi 6 time with sign the pressure was stabilizing .	
	12:05	Called it a day and would wait to pull the BP on Sunday	
4/6/24	23:50	Picked up pulling tool and checked all set screws	
	23:53	P/U Pulling tool, perforated pup to allow the tubing to fill and circulate above Pulling tool if need be. The first centralizer pup jnt was full of black tar like material and took 15 minutes to remove. Added the 3 centralizer pup jnts to BHA and began RIH	
4/7/24	5:20	Got P/U weight 66K S/O weight 50K and Hanging weight 54K at 9684'	
	6:30	Latched into BP with 15000 lbs down and picked up. Saw a 1000 lbs over pull on string at 9874	
	6:35	Racked back 1 full STD and on the 2 full stand took 8K over pull at 9752. Attempted to work the string twice and both times pulling 20K over with no success	
	6:45	S/O and broke out jnt and M/U pump in sub. Will circulate bottoms up at 3-5 bbls/min	
	6:52	Began circulating and will need 214 bbls for bottoms up	
	7:45	Shut pumps off and rigged down pumping equipment	
	7:50	M/U jnt to string in rotary and POOH	
	7:52	Took over pull again at 9752 and tried 2 with 20K. On 3rd attempt at 30K string passed through and did not want to go back down	
	12:15	OOH with running tool but no BP. There was a peek chevron that was 36' up on the centralizer pup jnt.	
	13:30	Run back in with the back up pulling tool to try to retrieve BP	
	16:30	Got P/U weight 70K, S/O weight 58K and hanging weight 62K at 9684'	
	16:40	Tagged BP at same spot with 5K. Did not engage with profile. Set down 10K and still nothing. Set down 20K and plug moved down.	
	16:45	Continue to RIH and push the BP below nipple	
	16:51	Tagged nipple with BP at 9874 with 8-10K and began to POOH	



Operator:	Utah FORGE	Base Point:	Waller, Texas
Company Rep:	Leroy Swearingen	Superior Rep:	Bobby Wojciechowski
Well Name:	16B(78)-32	Date Started:	3/24/2024
US Job #	0	Date Completed:	1/0/1900
County/State:	Beaver, Utah	Type of Job:	Bridge Plug/Frac
DATE	TIME	Description	
4/7/24	17:01	Never saw any over pull at 9752 where BP was hanging up.	
	20:46	Pulling tool OOH and collet had damage to half of the fingers, No Bridge Plug.	
	21:02	Laid down all components of BHA and began packing all tools on pallets.	
	22:00	Left location and headed back to hotel.	

Appendix A EDSD Open Hole Packer

PetroQuip Engineering Design Specification Document

Tool Name: 7" Open-Hole Packer (OHP)

Written by: Robert Coon

Date: 12/14/2021

Document Version: 1

Application:

Develop a 7-inch OHP that will isolate the different external sections (stages) of the casing by sealing between the 7-inch casing and the 8.500-inch to 9.750-inch open-hole. The OHP should be designed to withstand a differential pressure of 6,000 psi (41.37 MPA) and temperatures up to 437°F (225°C).

Operations:

Desired Method of Setting the OHP

The OHP should be threaded in the casing string at each point of external isolation. Proposed running procedure below:

1. The OHP is Run in Hole (RIH).
2. Once the casing is positioned in the Open-Hole, 3500 psi is applied to the ID of the casing string.
3. This setting pressure shears the anti-pre-set pins in each of the setting pistons of the OHP, which then compresses the packing element stack from both sides, setting the packer. This force is locked in via a Body Lock Ring. This piston remains in communication with the tubing ID for the life of the well, such that when any pressure greater than 3500 psi is applied, the force is transmitted to the element, potentially compressing it further.

Desired Method of Removing the OHP

The OHP can't be retrieved from the wellbore.

Specs: OHP

CASING	
Casing Size (in)	7
Casing Weight (lbs / ft)	38
Casing Drift (in)	5.795
OHP	
OD (in)	8.319 (max)
ID (in)	5.920 (nom) 6.043 (max)
OAL (in)	< 120
Pressure Rating Burst (psi)	10,800
Pressure Rating Collapse (psi)	11,390
Pressure Rating across the element (psi)	7,500
Open Hole ID	8.500 (min) 9.750 (max)
Element Length (in)	> 12
Temperature Rating (°F)	450
Min Pressure to Set (psi)	3500
Piston to set	Dual pistons pushing from both directions
Thread	TBD
Material	P-110
Coating	quench-polish-quench (QPQ), nitriding process

OHP Testing:

Pressure Test

This test confirms the design specs of the OHP for burst and collapse pressure ratings. The specs give it a pressure rating equal to 7,000 psi, 38 lb/ft casing. API typically applies a 20% safety factor to all ratings. The OHP should be designed to be more burst and collapse resistant than the casing.

Ambient Burst Pressure Test

1. Thread a bull plug to each end of the OHP. Attach a control line to one bull plug providing access to the ID of the OHP.
2. Replace the shear screws with steel pins or utilize a test clamp that keeps the setting pistons from moving.
3. Place the assembly (OHP and Bull Plugs) in the test cell and fill with water through the control line to the data acquisition panel. Ensure all air pockets are removed.
4. Apply 10,800 psi to the ID of the OHP for 30 minutes. A leak rate equal to or better than API 14L (1% loss over 15 minutes) is acceptable after stabilization.
5. Disassemble the test fixture and the OHP.
6. Perform a 100% inspection of the OHP to ensure that no damage occurred during the pressure test.

Ambient Collapse Pressure Test

7. Thread a bull plug to each end of the OHP. Attach a control line to one bull plug providing access to the ID of the OHP. Fill plugged LP with water, removing all air pockets.
8. Place the plugged OHP assembly into a chamber with a burst rating of at least 15,000 psi. Place another control line to the chamber itself. Thread Bull Plugs to each end of the chamber.
9. Secure test assembly into a Test Cell, and fill the chamber with water, removing all air pockets.
10. Apply 500 psi to the ID of the OHP and 11,900 psi to the ID of the chamber for 30 minutes. A leak rate equal to or better than API 14L (1% loss over 15 minutes) is acceptable after stabilization.
11. NOTE: A leak is defined as an increase in the ID of the OHP and a decrease in the ID of the Chamber.
12. After the test, bleed all pressure from both fixtures and disassemble.
13. Perform a 100% inspection of the OHP to ensure that no damage occurred during the pressure test.

Element Differential test at Temperature with Min Open Hole ID of 8.500 in.

1. Place the OHP in a section of horizontal casing with an ID of 8.500 inches. Bull plug the bottom end of the OHP and connect the top end to the same Bull plug that is threaded into the Test Casing (TC).
2. Bull plug the bottom of the TC and connect a control line to the test panel. This control line will monitor pressure below the elements.
3. Connect a control line to the ID of the top Bull Plug. This control line will monitor the pressure in the Packer ID.
4. Connect a control line to the outer portion of the same Bull Plug. This control line will monitor pressure above the elements.
5. Wrap the OD of the TC with heating coils.
6. Fill both chambers in the TC and OHP with water.
7. Heat the TC to 450°F, while keeping all fluid pressures between 500 psi and 1500 psi, and balanced.
8. After the temperature is stabilized at 450°F, balance all pressures to 500 psi.
9. Apply 4000 psi (3500 psi differential) to the ID of the OHP. This pressure will shear the setting pins and set the packer. Hold pressure for five minutes.
10. Relieve setting pressure on the OHP ID to 500 psi.
11. Communicate pressure below the elements and pressure in the OHP ID.
12. Apply 6500 psi (6000 psi differential) to the ID of the OHP and the bottom pressure chamber. This simulates a frac below the OHP.
13. Monitor the pressure above the OHP for communication across the elements. This increase would indicate a leak.

14. Once pressure is stabilized, hold the pressure for a minimum of 15 minutes. (Acceptance criteria is no more than 1% reduction in rated differential pressure over the hold period)
15. After the 15-minute pressure test, re-balance all pressures to 500 psi.
16. Apply 6500 psi (6000 psi differential) to the above pressure chamber. This simulates a frac above the OHP.
17. Monitor the pressure below the OHP for communication across the elements. This increase would indicate a leak.
18. Once pressure is stabilized hold the pressure for a minimum of 15 minutes. (Acceptance criteria is no more than 1 % reduction in rated differential pressure over the hold period).

Element Differential test at Temperature with Max Open Hole ID of 9.750 in.

1. Place the OHP in a section of horizontal casing with an ID of 9.750 inches. Bull plug the bottom end of the OHP and connect the top end to the same Bull plug that is threaded into the Test Casing (TC).
2. Bull plug the bottom of the TC and connect a control line to the test panel. This control line will monitor pressure below the elements.
3. Connect a control line to the ID of the top Bull Plug. This control line will monitor the pressure in the Packer ID.
4. Connect a control line to the outer portion of the same Bull Plug. This control line will monitor pressure above the elements.
5. Wrap the OD of the TC with heating coils.
6. Fill both chambers in the TC and OHP with water.
7. Heat the TC to 450°F, while keeping all fluid pressures between 500 psi and 1500 psi, and balanced.
8. After the temperature is stabilized at 450°F, balance all pressures to 500 psi.
9. Apply 4000 psi (3500 psi differential) to the ID of the OHP. This pressure will shear the setting pins and set the packer. Hold pressure for five minutes.
10. Relieve setting pressure on the OHP ID to 500 psi.
11. Communicate pressure below the elements and pressure in the OHP ID.
12. Apply 6500 psi (6000 psi differential) to the ID of the OHP and the bottom pressure chamber. This simulates a frac below the OHP.
13. Monitor the pressure above the OHP for communication across the elements. This increase would indicate a leak.
14. Once pressure is stabilized, hold the pressure for a minimum of 15 minutes. (Acceptance criteria is no more than 1% reduction in rated differential pressure over the hold period)
15. After the 15-minute pressure test, re-balance all pressures to 500 psi.
16. Apply 6500 psi (6000 psi differential) to the above pressure chamber. This simulates a frac above the OHP.
17. Monitor the pressure below the OHP for communication across the elements. This increase would indicate a leak.
18. Once pressure is stabilized hold the pressure for a minimum of 15 minutes. (Acceptance criteria is no more than 1 % reduction in rated differential pressure over the hold period).

Appendix B EDSD Locking Bridge Plug and Landing Profile

PetroQuip Engineering Design Specification Document

Tool Name: 7” HPHT Locking Bridge Plug (LBP) and Landing Profile (LP)

Written by: Robert Coon

Date: 2/9/2022

Document Version: 2

-Modified the casing weight from 32# to 38#

Application:

Develop a Locking Bridge Plug (LBP) that isolates different internal sections (stages) of the casing by locating and sealing in a Landing Profile (LP) installed on and run with the casing. The LP can also be run as part of a full completion system with additional tools as needed (e.g. liner hanger, flow initiation toe sub). The system will be utilized in both the Cased and the Open-Hole applications.

Operations:

Desired Method of Setting the LBP

The LP should be threaded in the casing string. The LP will be positioned within the casing string and provide a location to land the LBP inside the well. The LP and the LBP should both be designed to work in cemented and un-cemented applications. Proposed running procedure below:

1. The LBP is Run In Hole (RIH) on pipe (threaded or coiled) with a Running Tool (RT). This can be referred to as a Bottom Hole Assembly (BHA).
2. Once the BHA is above the LP, 1000 psi is applied internally to the pipe, exposing No-Go Dogs on the RT.
3. The BHA is RIH until the No-Go Dogs stop against the shoulder inside the LP.
4. Increase internal pressure on then pipe to 3,000 psi, setting the LBP in the LP.
5. The BHA is then lifted to shear the RT from the LBP. This shear confirms that the LBP is set and the BHA is Pulled Out Of Hole (POOH).

Desired Method of Removing the LBP

The LBP should be designed to be removed by a modified GS Pulling Tool (GS) on pipe or milled up with a mill or bit on pipe. Proposed Procedure Below:

GS and Pipe

1. RIH with a GS and pipe.
2. Set down against the fishing neck of the LBP, engaging the GS into the LBP.
3. Pull the BHA up hole. This should unlock and release the LBP.
4. POOH BHA.

Mill and Pipe

1. RIH with a 5-3/4” Mill or Roller Cone bit.
2. Set down against the LBP, then pick up 5 ft. Increase circulation
3. Start the rotation on the Mill or Bit
4. Set back down on the LBP with 6000 lbs of force
5. Mill up the LBP and circulate the pieces to the surface

Specs: Landing Profile (LP)

CASING	
Casing Size (in)	7
Casing Weight (lbs / ft)	38
Casing Drift (in)	5.795
LANDING PROFILE (LP)	
OD (in)	7.656
ID Seal Bore (in)	5.625
OAL (in)	<60
Pressure Rating Burst (psi)	10,000
Pressure Rating Collapse (psi)	10,000
Temperature Rating (°F)	450
Thread	TBD
Material	P-110
Coating	thermochemical quench-polish-quench (QPQ), nitriding process

Specs: Locking Bridge Plug (LBP)

CASING	
Casing Size (in)	7
Min Casing Weight (lbs / ft)	38
Casing Drift (in)	5.795
LOCKING BRIDGE PLUG (LBP)	
OD (in)	5.550 ?
ID (in)	>2.500
Temperature Rating	450°F
OAL (in)	>30
Tubing Pressure to set (psi)	<3000
Pressure Rating (psi) from above	7,500 min
Pressure Rating (psi) from below	0, checks from above
Material	Millable
ID isolation of the LBP	Flapper or ball
Thread	na
Rotationally locked	Yes
Selective Style Location	Expandable No-Go with 1000 psi pressure applied
Installation Method	Running Tool - <3000 psi applied
Shear Release once set	Doesn't release until LBP is fully set, then straight pull to overcome shear

Landing Profile (LP) Testing (component only):

Pressure Test

This test confirms the design specs of the LP for burst and collapse pressure ratings. The specs give it a pressure rating equal to 7" 32# casing. API typically applies a 20% safety factor to all ratings. The LP should be designed to be more burst and collapse resistant than the casing.

Burst Pressure Test

1. Thread two bull plugs to each end of the LP.
2. Place the assembly (LP and Bull Plugs) in the test cell and fill with water through the control line to the data acquisition panel. Ensure all air pockets are removed.
3. Place an inductive heater on the OD of the fixture.
4. Apply 10,000 psi to the ID of the fixture for 5 minutes to ensure there are no leaks in the fittings of the control lines or threads before applying temperature. After 5 minutes, reduce the pressure to 1000 psi.
5. Turn on the inductive heater to 450°F to heat the fixture and water to the working temperature of the LP.
6. Maintain 1000 to 2000 psi while heating. Once the temperature has stabilized at 450°F the pressure will be increased to 10,000 psi for 30 minutes. A leak rate equal to or better than API 14L (1% loss over 15 minutes) is acceptable after stabilization.
7. Turn the heater off and reduce the pressure to 3000 psi. Once it is cooled reduce the pressure to 0 psi, remove the heating coils, then remove the LP from the Test Cell.
8. Perform a 100% inspection of the LP to ensure that no damage occurred during the pressure test.

Collapse Pressure Test

1. Thread a bull plug to each end of the LP, and attach a control line to one bull plug providing access to the ID of the LP. Fill plugged LP with water, removing all air pockets.
2. Place the plugged LP assembly into a chamber with a burst rating of at least 12,000 psi. Place another control line to the chamber itself.
3. Secure test assembly into a Test Cell, and fill chamber with water, removing all air pockets.
4. Apply 500 psi to the ID of the LP and 10,500 psi to the ID of the chamber. This pressure is held for 5 minutes to ensure that there are no leaks.
5. After the ambient pressure test, reduce the pressure in the chamber to 3000 psi and leave the pressure on the ID of the LP at 500 psi.
6. Wrap the OD of the chamber with the inductive heater coils and increase the temp to 450°F. Bleed pressure off as the heat increases in both volumes, keeping the Chamber between 3000 and 5000 psi, and the LP between 500 and 1,500 psi.
9. Once temperature has stabilized at 450°F, apply 500 psi on the ID of the LP and 10,500 psi on the ID of the chamber for 30 minutes. A leak rate equal to or better than API 14L (1% loss over 15 minutes) is acceptable after stabilization.
7. **NOTE:** A leak is defined as an increase in the ID of the LP and a decrease in the ID of the Chamber.
8. Turn the heater off and reduce the pressure to 3,000 psi on the ID of the Chamber and leave the LP ID pressure at 500 psi. Once cooled, reduce both internal and external pressures to 0 psi, remove the heating coils, and remove the LP from the Test Cell.
9. Perform a 100% inspection of the LP to ensure that no damage occurred during the pressure test.

Locking Bridge Plug (LBP) Testing:

Function Test (ambient):

1. Place the tested Landing Profile (LP) in a vise.
2. Take the assembled LBP and Running Tool (RT), attach the RT to the LBP, (now referred to as a BHA). Attach BHA to hydraulic ram, and use ram to pass BHA through the LP from the top side of the LP to the bottom side of the LP.
3. Pull the Assembly back through the LP bottom to top, ensuring No-Go Dogs are at least six inches above No-Go Shoulder of LP.
NOTE: The only engagement between the BHA and the LP is the seal stack sliding thru the polished bore of the LP.
4. Apply 1000 psi to the BHA, extending the No-Go Dogs. Push the BHA into the LP. The No-Go Dogs on the BHA will stop it from going any further into the LP. Apply 10,000 to 15,000 lbf against the No-Go Shoulder via hydraulic ram.
5. Apply 3000 psi down tubing to the BHA and set the lock in the LP.
6. Reduce setting pressure to 0 psi.
7. Utilizing the hydraulic ram, shear release the RT from the LBP to complete the setting sequence, and record the load required.
8. Remove RT from hydraulic ram, and attach GS Pulling Tool.
9. Remove the LBP with the GS. Record the force to retrieve the LBP from the LP.
10. Perform a 100% inspection to ensure no damage occurred during the test to the LBP, RT, or GS.

Operation Test (temperature and pressure)

1. Set the LBP using the same procedure described above (Steps 1-7). The LP with installed LBP will be referred to as the Test Assembly.
2. Install Bull Plugs to each end of the Test Assembly.
3. Fill the Test Assembly with water by pumping from the bottom (the LBP flapper or ball will open automatically, allowing fluid to flow above the LBP).
4. Place the Test Assembly inside in the test cell and wrap it with the heating coils.
5. Place control lines to each bull plug, and attach lines to the data acquisition.
6. Apply 8,000 psi above the LBP, and 500 psi below the LBP. Wait for the pressure to stabilize. Hold differential for 30 minutes. Any pressure loss on the 8,000 psi and increase on the 500 psi will indicate a leak. A leak rate equal to or better than API 14L (1% loss over 15 minutes) is acceptable after stabilization.
7. Reduce pressure above and below the LBP to 1,000 psi.
8. Heat the test fixture to 450°F while maintaining a pressure of 1000 – 2000 psi to each side of the LBP.
9. Once the temperature is stabilized at 450°F, apply 8,000 psi above the LBP, and 500 psi below the LBP. Wait for the pressure and temperature to stabilize. Hold for 30 minutes. Any pressure loss on the 8,000 psi and increase on the 500 psi will indicate a leak. A leak rate of under 1% (60psi per API 14L) is acceptable over 15 minutes.
10. Reduce pressure above LBP to 3000 psi, and pressure below LBP to 500 psi. Remove heat and allow Test Assembly to cool. Once cooled, reduce all pressures to 0 psi and remove bull plugs from LP.
11. Retrieve the LBP with the GS. Record the force to pull the LBP from the LP.
12. Perform a 100% Inspection to ensure no damage occurred during the test to either the LBP, LP, or GS.

Locking Bridge Plug (LBP) Testing (Cont'd):

Contingency Retrieval Test

1. Repeat Operation Test (Steps 1-10).
2. Place the Test Assembly on a lathe with a Mill.
3. Document the time it takes to mill the LBP with a 5.75" bit.
4. Collect the debris and document the size particles.

Debris Test (ambient)

1. Repeat Function Test (Steps 1-7) of the function test, except for adding 100 mesh sand to the water at a consistency of 3 lbs/gallon that is used to fill the assembly.
2. Remove the LBP with the Internal Spear Retrieving Tool. Record the force to pull the LBP from the LP.
3. Perform a 100% Inspection to ensure no damage was done during the test to either the LBP or the LP.

Appendix C Final Test Report - Open Hole Packer



Safety, Environmental, and Performance Test Report



Open Hole Packer

Test 24

MTS Project Number
7002-22-2009

April 2024

Test Report for
Open Hole Packer
Test 24

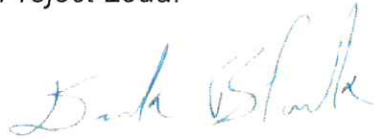
April 2024

Revision 0

PetroQuip Energy Services

Authorized By: Robert Coon

Project Lead:



Derik Black, Senior Technician

Project Manager:



Scott Wilson, Vice President



Table of Contents

1. Executive Summary
2. Test Procedure, Assembly Layout, Accumulator Data
3. Test Setup Pictures
4. Technician Hand Logs
5. Test Plots
6. MTS Torque Graphs
7. PetroQuip Torque Graphs
8. Operations Review
9. Meeting Sign in Sheets
10. Health, Safety, Environmental Review
11. Equipment Calibration

1	Executive Summary
---	-------------------

Executive Summary

Mechanical Testing Services tested the Open Hole Packer to the test procedure provided by PetroQuip Energy Services. MTS and PetroQuip worked together to develop this detailed test procedure. In addition, MTS and PetroQuip reviewed all safety concerns and needs for special fixtures and equipment for performing the test. Before work started, both teams had a safety meeting and operations review to ensure all precautions were taken.

PetroQuip assembled the test specimen and MTS setup thermocouples, induction heating, and the accumulator. MTS filled the test article with water. The specimen was then loaded into the test bunker.

On Monday, April 22, Steps 1-7 were completed. On night shift, Step 10 was unable to complete because "Below" and "Tubing" communicated. The technician proceeded to Prototype Validation Step 12. Heat was applied until the specimen was stable at temperature. The Setting and Setting Hold were successful. Differential from "Above" was successful. During "Below" differential, the technician observed communication between "Above" and "Below". The technician proceeded to troubleshoot and could not obtain a differential pressure between any zone.

Testing was stopped again. The specimen was removed from the test bunker and disassembled.

2	Test Procedure, Assembly Layout, Accumulator Data
---	--

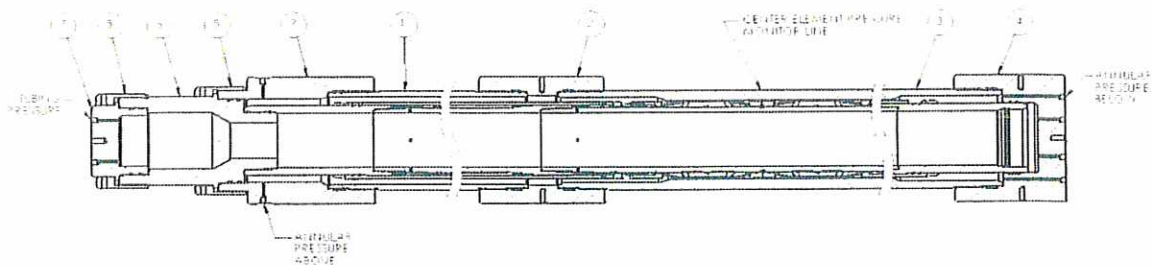
Test 24

7.000 X 9.750 Open Hole Packer

API 19OH (1st Edition) V3-Style Test (8.500 ID)

Fixture Integrity Validation

1. Perform hazard assessment and hold operational safety meeting.
2. Assemble the full test fixture as per PetroQuip drawing PQA334 (see image below).
3. Fill the entire test fixture (tubing and annulus lines) with water. Burp the fixture periodically to purge trapped air bubbles.
 - a. NOTE: Water must be used as the test medium due to EPDM elements
4. Connect lines to Tubing Pressure, Annular Pressure Above, Annular Pressure Below and Center Element Pressure Monitor. Communicate both Annular Pressure lines. Isolate Tubing line and Center Element Pressure Monitor. Plug all other fixture ports.
5. Set data recording to 1 Hertz and start a new file.
6. Pressure both Tubing and Annular lines to 10,000 psi (+5%/-0 psi) in increments of 2,000 psi. Hold each step for 60 seconds. Once 10,000 psi is reached, hold for 15 minutes without pressure loss greater than 1% over 15 minutes. Note: The pressure Center Element Pressure Monitor line will increase with annular pressure.
7. Relieve pressure on all lines.



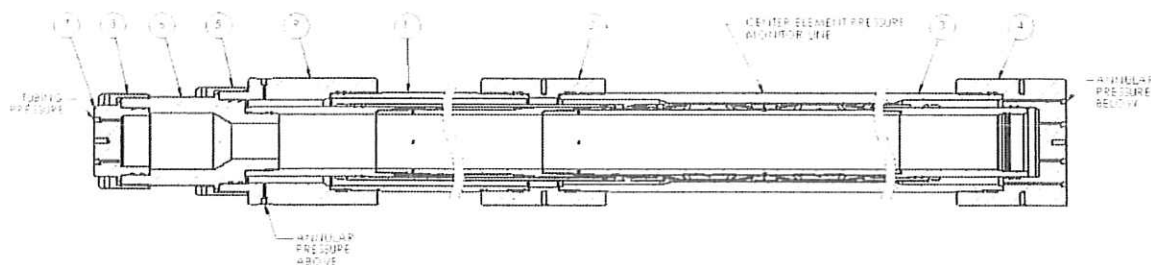
Prototype Integrity Validation

8. Separate Annular and Tubing communication.
9. Apply 500 psi to Annular and Tubing lines.
10. Pressure Annular side to 8,000 psi (+5%/-0 psi) differential in increments of 2,000 psi. Hold each step for 60 seconds. Once 8,000 psi differential is reached, hold for 15 minutes without pressure loss greater than 1% over 15 minutes. Pressure loss is defined as an increase in Tubing pressure due to loss of Annular pressure.
11. Relieve Annular pressure back to 500 psi.

Unable
to
Complete
Due to
Below & Tubing
Communicating

Prototype Function Validation

12. Maintain 500 psi on all lines.
13. Heat up assembly to 450°F (+30/-0°F) at a maximum rate of 300°F/hr until temperature is stable and soaked (min 12 hours). Monitor Tubing, Annular and Center Element Pressure Monitor pressure, not letting either surpass 1000 psi during heat soak.
14. Perform steps 15 and 16 during the heat up.
15. Set data recording for 10 Hertz.
16. Plumb Accumulator in line with Tubing side. Set Accumulator for 4500 psi setting pressure.
17. Set the Center Element Pressure Monitor line to auto-bleed pressure and maintain 500 psi during the setting procedure.
18. Increase Tubing side pressure via accumulator to set the packer using the following pressure while maintaining 500 psi on the Annular side:
 - a. 4500 psi (4000 psi differential) (+5%/-0 psi), set packer and hold for 5 min
19. Relieve Tubing and Annular pressure back to 500 psi
20. Ensure that pressure lines are separated per the below diagram, and not in communication with each other.
21. Remove auto-bleed from Center Element Pressure Monitor line and monitor for the remainder of the test.



22. Remove Accumulator from Tubing line.

Prototype Performance Validation

23. Set data recording for 1 Hertz.

Pressure Above Elements at 450F

24. Communicate Tubing and Annular Above lines. Isolate Annular Below line.
25. Apply pressure to Annular Above using the following progression:
 - a. 2000 psi differential (+5%/-0 psi), hold for 3 min
 - b. 4000 psi differential (+5%/-0 psi), hold for 3 min
 - c. 6000 psi differential (+5%/-0 psi), hold for 3 min
 - d. 7500 psi differential (+5%/-0 psi), hold for 60 minutes without pressure loss greater than 1% over 15 min
26. After hold, reduce all pressures to 500 psi.

Pressure Below Elements at 450F (1st Reversal)

27. Communicate Tubing and Annular Below lines. Isolate Annular Above line.
28. Apply pressure to Annular Below using the following progression:
 - a. 2000 psi differential (+5%/-0 psi), hold for 3 min
 - b. 4000 psi differential (+5%/-0 psi), hold for 3 min
 - c. 6000 psi differential (+5%/-0 psi), hold for 3 min
 - d. 7500 psi differential (+5%/-0 psi), hold for 60 minutes without pressure loss greater than 1% over 15min
29. After hold, reduce all pressures to 500 psi.

Pressure Above Elements at 450F (2nd Reversal)

30. Communicate Tubing and Annular Above lines. Isolate Annular Below line.
31. Apply pressure to Annular Above using the following progression:
 - a. 2000 psi differential (+5%/-0 psi), hold for 3 min
 - b. 4000 psi differential (+5%/-0 psi), hold for 3 min
 - c. 6000 psi differential (+5%/-0 psi), hold for 3 min
 - d. 7500 psi differential (+5%/-0 psi), hold for 60 minutes without pressure loss greater than 1% over 15 min
32. After hold, reduce all pressures to 500 psi.

Pressure Above Elements at 250F (1st Thermal Cycle)

33. Reduce temperature to 250F. Allow fixture to stabilize at temperature for 8 hours prior to continuing.
34. Communicate Tubing and Annular Above lines. Isolate Annular Below line.
35. Apply pressure to Annular Above using the following progression:
 - a. 2000 psi differential (+5%/-0 psi), hold for 3 min
 - b. 4000 psi differential (+5%/-0 psi), hold for 3 min
 - c. 6000 psi differential (+5%/-0 psi), hold for 3 min
 - d. 7500 psi differential (+5%/-0 psi), hold for 60 minutes without pressure loss greater than 1% over 15 min
36. After hold, reduce all pressures to 500 psi.
37. Communicate all pressure lines.

Pressure Above Elements at 450F (2nd Thermal Cycle)

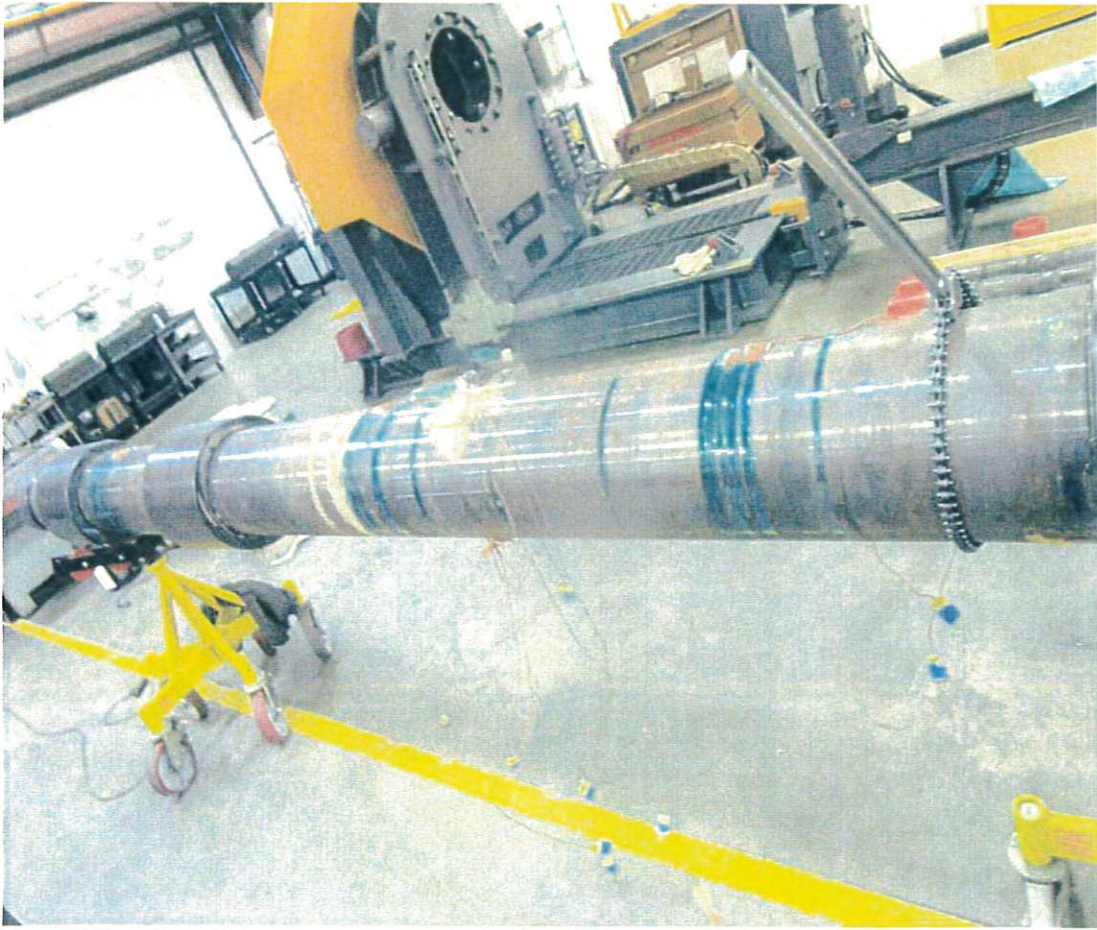
38. Heat up assembly to 450°F (+30/-0°F) at a maximum rate of 300°F/hr until temperature is stable and soaked (min 12 hours). Monitor pressure, not letting it surpass 1000 psi during heat soak.
39. Communicate Tubing and Annular Above lines. Isolate Annular Below line.
40. Apply pressure to Annular Above using the following progression:
 - a. 2000 psi differential (+5%/-0 psi), hold for 3 min
 - b. 4000 psi differential (+5%/-0 psi), hold for 3 min
 - c. 6000 psi differential (+5%/-0 psi), hold for 3 min
 - d. 7500 psi differential (+5%/-0 psi), hold for 90 minutes without pressure loss greater than 1% over 15 min
41. After hold, reduce all pressures to 500 psi.

End Test Activities

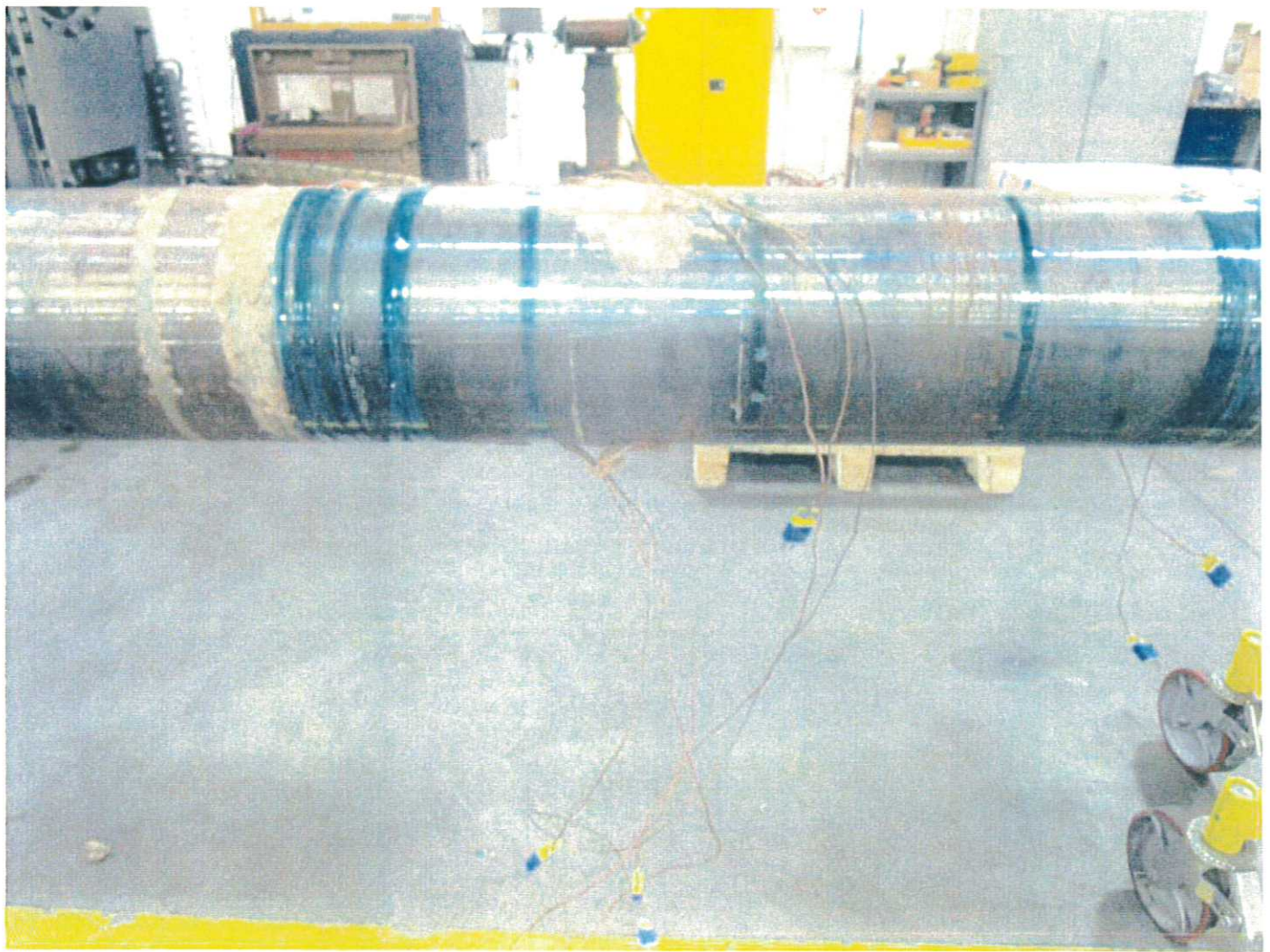
42. Reduce temperature to ambient.
43. Retrieve Open Hole Packer from test casing while recording max cylinder pressure required to push. Convert cylinder pressure to lbf based on attached load chart.
44. Send all test articles to inspection and prepare for next test.

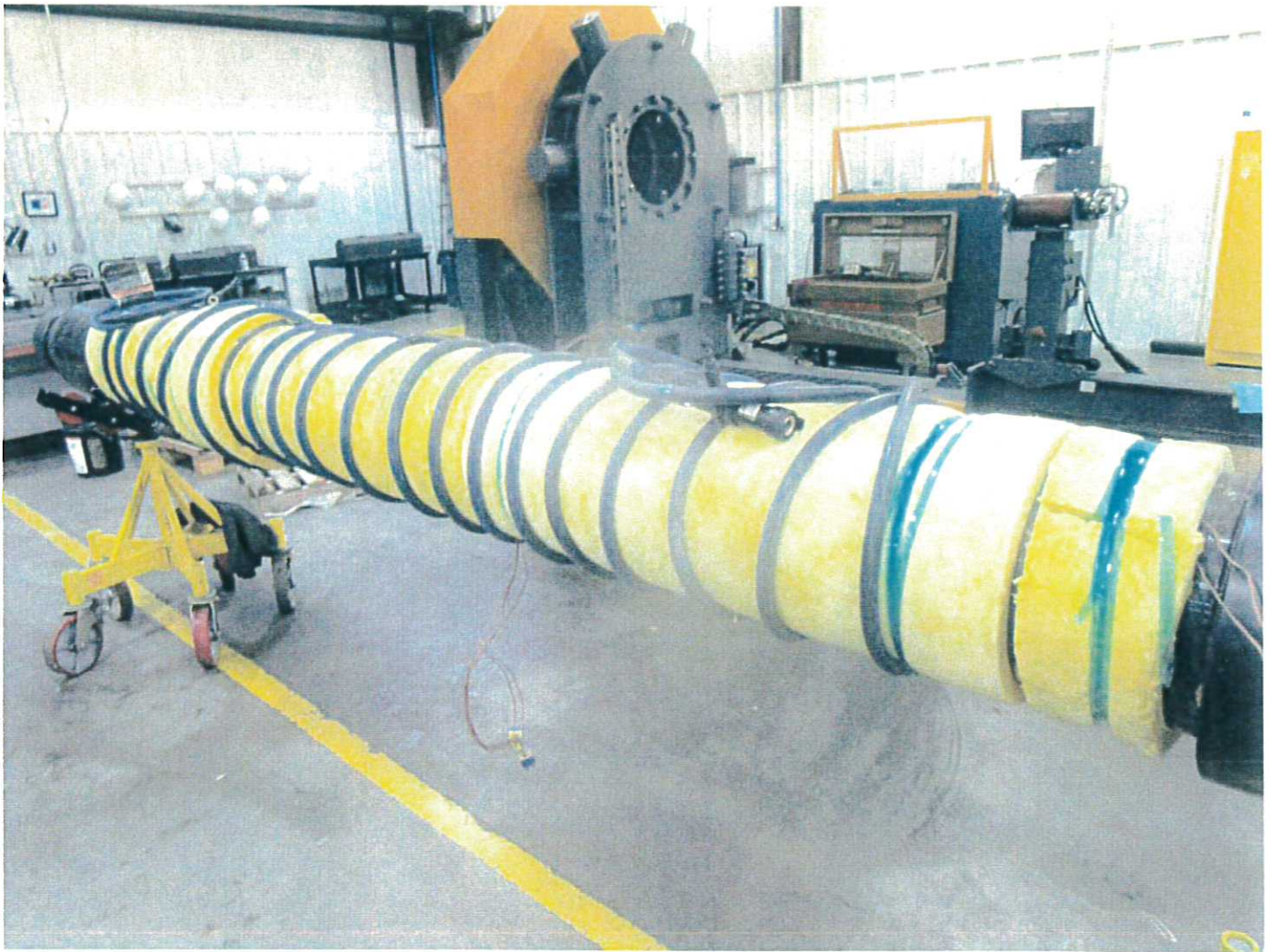
		Note: Engineering Use Only							
	Revision:								
	Date:								
	Completed By:								
	Checked By:								
	Approved By:								
Guideline for Calculating Accumulator Charging Pressure for Setting Packers									
<table border="1"> <tr> <th colspan="2">Ref. Accumulator Volumes (in³)</th> </tr> <tr> <td>PQA343 SHOP ACCUMULATOR</td> <td>5040</td> </tr> <tr> <td></td> <td></td> </tr> </table>				Ref. Accumulator Volumes (in ³)		PQA343 SHOP ACCUMULATOR	5040		
Ref. Accumulator Volumes (in ³)									
PQA343 SHOP ACCUMULATOR	5040								
Inputs									
Required Setting Pressure	4500	psi							
Setting Stroke of Packer	6.000	inches							
Setting Cylinder ID	7.625	inches							
Setting Mandrel OD	7.000	inches							
Number of Setting Pistons	4	qty							
Volume of Accumulator	5040	in ³							
Gas Pressure in Accumulator (2000psi typical)	2000	psi							
Intermediate Calculations:									
Setting Piston Area of Packer	28.716	in ²							
Volume of fluid displaced to set packer	187.4	in ³							
Packer Setting Force	64611	lbf							
Accumulator Gas Calculations Based on Boyle's Law									
Pfill * Vfill = Pset * Vset									
Pfill =	2000	psi (pressure for gas filled in accumulator)							
Vfill =	5040	in ³ (vol. of gas filled in accumulator)							
Pset =	4500	psi (required setting pressure)							
Vset =		Volume of gas when packer is set (in ³)							
Vset =	2240	in ³							
Vcharge = Vset - Volume of fluid displaced to set packer (+ 25 in³)									
Vcharge =	2028	cubic inches							
Pfill * Vfill = Pcharge * Vcharge									
Pfill =	2000	psi (gas value for accumulator)							
Vfill =	5040	in ³ (vol. of gas filled accumulator)							
Pcharge =		psi (water charge pressure (= gas pressure))							
Vcharge =	2028	Volume of gas when charged (in ³)							
Pcharge =	4971	psi							
Outputs									
Fill one side of accumulator with gas to	2000	psi							
Charge other side of accumulator with water to	4971	psi *							
* Note water charge pressure is the final total accumulator pressure									

3	Test Setup Pictures
---	---------------------











4	Technician Hand Logs
---	----------------------

Customer: _____ PetroQuip _____ Project No.: 7002-22-2009

Project/ Material Description: Open Hole Packer

Time	Load Step	RAM		Tubing	Below	Above	Temperature		LVDT	Leak Detection
		UP	DOWN				0	180		
1646	6			10234	10238	10238	81	81		
Test Notes: Start 15 min hold										
1701	6			10178	10177	10179	82.9	81.7		
Test Notes: end 15 min hold										
Test Notes: ↓ Night shift										
2120	9			483	485	495	79.9	79.3		
Test Notes: UP to 500 psi										
Test Notes: - AT step 90 noticed tubing below not communicated.										
Test Notes: - while pressuring up at step 10 to 8000 psi diff. the below tubing communicated										
Test Notes: - Per Lee bleed tubing, above below to 500 psi heat up.										
Test Notes: 12 bleed to 500 psi.										
Test Notes: begin Heat UP										
Test Notes: Begin soak										
0342	13			450	464	454	458.5	446.2		
Test Notes: Per Client setting with 5 hr of heat soak										
0844	Per Client									

Completed By: Jason Novak/Mike Dakic Date: 4/22/24

Customer/TPI: _____ Date: _____

Page 1 of 4

Customer: _____

Project No _____

Project/ Material Description _____

Time	Load Step	RAM		Tubing	Above	Below	Temperature		LVDT	Leak Detection
		UP	DOWN				0	180		
0859	18	-	-	4526	434	468	458.9	445.8	-	-
Test Notes										
0904	18	-	-	4574	457	470	459.7	444.7	-	-
Test Notes										
0935	25A	-	-	7090	2128	470	459.7	445.2	-	-
Test Notes										
0938	25A	-	-	2067	2109	468	459.3	445.1	-	-
Test Notes										
1254	25d	-	-	8183	8182	501	457.8	447.0	-	-
Test Notes										
1309	25d	-	-	8141	8141	517	457.8	446.6	-	-
Test Notes										
1324	25d	-	-	8109	8110	522	458.1	446.7	-	-
Test Notes										
1339	25d	-	-	8085	8085	523	457.8	446.6	-	-
Test Notes										
1516	28d	-	-	8245	491	8257	457.4	447.4	-	-
Test Notes										
1531	28d	-	-	8250	631	8255	457.4	447.4	-	-
Test Notes										
1547	28d	-	-	8235	744	8238	457.0	447.5	-	-
Test Notes										
16:01	28d	-	-	8196	824	8197	457.0	447.8	-	-

Completed By Zach

Date _____

Customer/TPI _____

Date _____

Customer _____

Project No _____

Project/ Material Description _____

Time	Load Step	RAM		Tubing	Above	Below	Temperature		LVDT	Leak Detection
		UP	DOWN				0	180		
18:49										
Test Notes	Unable to maintain below differential. drop psi to 500 to check for sitting leak									
Test Notes	Due to above 3 below being communicated									
Test Notes	Per client attempt to do hold from above									
19:48	31A			252-3	2549	491	458	447		
Test Notes	3 min Hold									
19:51				2546	2570	498	457.8	447		
Test Notes										
19:58	31B			4301	4312	514	457.8	447		
Test Notes	attempt 3 min Hold									
20:01				4212	4223	658	457.4	447		
Test Notes										
Test Notes	Unable to complete 4000 psi differential Hold above per client bleed to 500 psi									
Test Notes	? cool to ambient.									
00:33		Begin	Soak							
Test Notes										
08:58		-	-	471	478	473	457.4	447.1	-	-
Test Notes	Begin pressure up from above									

Completed By

Zach Evans / Jason Novak
VTS Technician / Subject Manager

Date 4/23/24

Customer/TPI _____

Date _____

Page 3 of 4



Customer: _____

Project No _____

Project/ Material Description _____

Time	Load Step	RAM		Tubing	Above	Below	Temperature		LVDT	Leak Detection
		UP	DOWN				0	180		
0901				2188	2186	480	437.4	447.0		
Test Notes	Start	3	min	4191	hold	from	above			
0908				3 min	hold	from	above			
Test Notes	Start	3	min	3037	3634	2437	456.5	448.1		
0932				maintain	differential	while	pumping	observes		
Test Notes	could not									
Test Notes	communication	between			above, tubing, and below	with element				
Test Notes	pressure	remaining			stable					
0935				3633	3631	2508	436.3	448.1		
Test Notes	Per client	communicate			all zones	and cool to ambient.				
Test Notes										
Test Notes										
Test Notes										
Test Notes										
Test Notes										
Test Notes										
Test Notes										

Completed By

Mike Doka
MTS Technician Project Manager

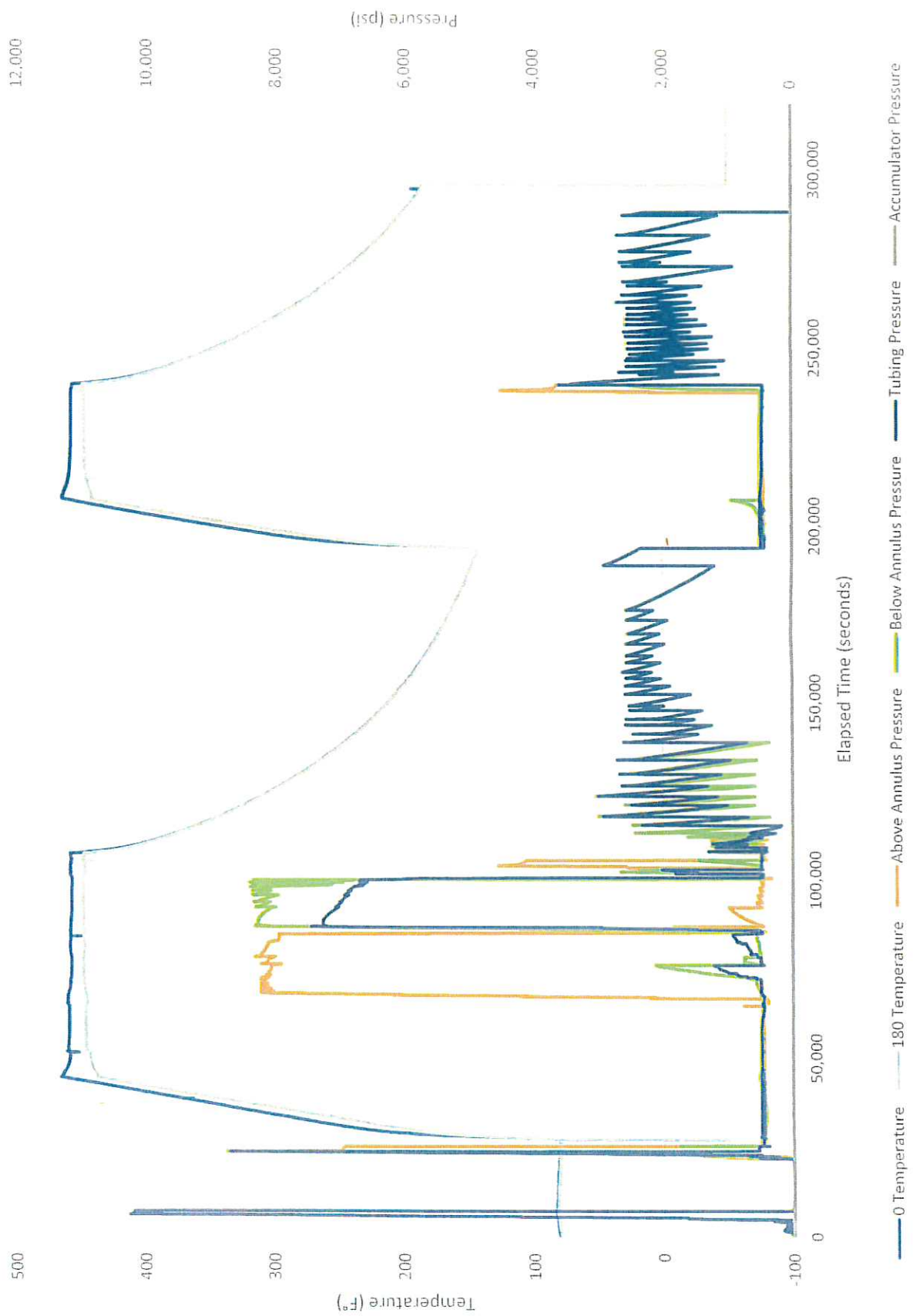
Date

Customer/TPI

Date

5	Test Plots
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Graph



6	MTS Torque Graphs
---	-------------------

No MTS Torque Graphs

7	PetroQuip Torque Graphs
---	-------------------------

No PetroQuip Torque Graphs

8	Operations Review
---	-------------------

		Review No.		7002-22-2009-OR	
Project Information					
Customer:	PetroQuip		Date:	4/22/2024	
MTS Project No.:	7002-22-2009		Project Manager:	Scott Wilson	
Project Title:	Utah Forge Testing		Customer PO ^(select)	☐ YES ☐ NO	
PO Received / PO Not Received					
Project Description	See attached Procedure				
Test Description					
Test Procedure Summary	See attached				
Temperature	Minimum:	Ambient	Maximum:	450 F	
Pressure	Minimum:	0	Maximum:	10,000	
Load	Minimum:	0	Maximum:	0	
Test Media	Liquid:	Water	Gas:	N/A	
Required Data Collection	Pressure, Temperature				
Required Equipment	Custom				
Electrical Safety	Check induction lines for damage, ground test article				
Required PPE	Standard				
Barrier Selection	MTS Underground Bunker - Outside				
Stored Energy	E=	ft-lbs	E=	N/A	lbs of TNT
Max Pressure Ratings	Temperature		Pressure Circuit		Fittings
	Ambient		psi		psi
	Elevated		psi		psi
Technicians					
Hazard Assessment <i>*Refer to Standing Job Hazard Analysis (JHA) Mitigation/Elimination Detail</i>					
Environmental Hazards (Daily JSA)					
Operational Hazards (Daily JSA)	Potential for stored energy release. Exposure to compressed test media. Manual handling of loads. Fork life operation, pinch/crush hand/ legs				

Pre-Test Checks and Approvals		
Description	Verification	Comments
Adequate Illumination (lighting)	☐ YES ☐ NO	
Slip/Trip/Fall Hazards / JSA Initiated	☐ YES ☐ NO	
Organized Test Set-up	☐ YES ☐ NO	
Organized Work Area	☐ YES ☐ NO	
All Test Media Labeled	☐ YES ☐ NO	
All Pressure Line(s) Labeled	☐ YES ☐ NO	
Calibrated Equipment Verified & Current	☐ YES ☐ NO	
Sensors adequate for Test	☐ YES ☐ NO	
Test Specimen assembled per Customer requirements	☐ YES ☐ NO	
Test Specimen ports connected per pressure diagram	☐ YES ☐ NO	
Standing JHA / JSA Addendum Initiated	☐ YES ☐ NO	*Daily JSA is required

Operations Review Sign-Off	
Preliminary Sign-Off	Final Sign-Off
Technician <u>Michael Duke</u> <u>4-22-24</u>	<u>Michael Duke</u> <u>4-22-24</u>
Technician _____	_____
Technician _____	_____
Customer _____	_____
Customer _____	_____
Project Manager <u>Scott Wilson</u> <u>4/22/24</u>	_____
Director of Completions _____	_____
Other (Specify) _____	_____

Attachments (as applicable)	
Attachment 1	Detailed Test Procedure
Attachment 2	Test Media MSDS
Attachment 3	Test Layout, Assembly Drawings & Detailed Drawings of Fixtures
Attachment 4	Manufacturing Documents (MTR, WPS, PQR, Etc.)
Attachment 5	Stored Energy & Critical Component Analysis
Attachment 6	Test Article Serial Number Photo / traceability stamping (as applicable)
Attachment 7	Channel List (including calculated channels)

9	Meeting Sign in Sheets
---	------------------------

Meeting Description:
Safety Meeting

Date:
April 22, 2024

Meeting Leader:
Scott Wilson

Location:

Attendees

	Name	Role	Signature
1.	Scott Wilson	VP	Scott Wilson
2.	Mike Dake	Tech	Mike Dake
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			

10	Health, Safety, Environmental Review
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Health Safety & Environmental				Document Name:	Daily Job Safety Analysis (JSA) Addendum
				Section:	HSE-8
Revision	3	Date	3/25/2022	Document Number:	MTS-8-4-A

Date:				Work Area:		
Description of Work Activity:						
Evacuation Routes Identified:		Yes	No	Muster Point:		

APPLICABLE STANDING JOB HAZARD ANALYSIS (JHA) (check all that apply)							
☐	Crane Operations	☐	Forklift Operations	☐	Hydro Test Operations	☐	Install-Remove Rigging
☐	Overhead Crane Operations	☐	Test Specimen Preparation	☐	WHSE Issue & Receive Mat'l	☐	Welding-Hot Work

POTENTIAL HAZARDS (check all that apply)							
☐	Lifting Hazard, Muscle Strain	☐	Fire or Explosion Potential	☐	Potential Energy Release	☐	Hazardous Chemical Exposure
☐	Pinch, Crush, Strike Hazards	☐	Limited Access/Egress	☐	Low Light	☐	Open Holes, etc.
☐	Slips, Trips and Falls	☐	Line of Fire	☐	Travel Path Obstructions	☐	Traffic, Equipment Hazards
☐	Electrical Shock	☐	High Noise Level (≥ 90 db)	☐	Rotating Machinery	☐	Fall Hazards (6ft-greater)
☐	Overhead Hazards	☐	Hot / Cold Surfaces	☐	Severe Weather-High Winds	☐	Heat / Cold Stress
Other:							

SAFETY EQUIPMENT (check all that apply)							
☐	Hard Hats	☐	Nitrogen Monitor	☐	Barricades	☐	Whip Checks
☐	Safety Shoes (task appropriate)	☐	4-Gas Monitor	☐	Ladder, Portable Stairway	☐	Jacks, Rollers, Dolly-Pallet Jack
☐	Safety Glasses	☐	Personal Gas Monitor	☐	Equip Guards (Tool-Machines)	☐	Environmental Health : SDS
☐	Gloves	☐	Face Shields / Goggles	☐	Absorbant Pads/Containment	☐	
☐	Hearing Protection	☐	Flags / Air Horn	☐	Fall Protection	☐	
☐	Respirator	☐	First Aid Kit	☐	Fire Extinguishers	☐	
Other:							

APPLICABLE SAFE WORK PRACTICES (check all that apply)							
☐	Forklift/PID MTS-HSE-4-2	☐	Machine Guarding MTS-HSE-6-5	☐	Tool Safety MTS-HSE-3-15	☐	Rigging/Lifting MTS-HSE-3-13
☐	Housekeeping MTS-HSE-6-4	☐	Weld/Hot Work MTS-HSE-3-16	☐	First Aid/CPR MTS-HSE-2-2	☐	Fire Prevention MTS-HSE-3-7
☐	Use of PPE MTS-HSE-3-12	☐	Stop Work Auth. MTS-HSE-3-15	☐	Fall Protection MTS-HSE-3-6	☐	HAZCOM MTS-HSE-3-8
☐	Resp. Protection MTS-HSE-5-11	☐	Crane Operations MTS-HSE-3-3	☐	Gas Hazards MTS-HSE-5-6	☐	Barricades MTS-HSE-3-1
☐	Waste Manage MTS-HSE-6-4	☐	Material Handling MTS-HSE-3-11	☐	Ladder Safety MTS-HSE-3-9	☐	Hearing Con. MTS-HSE-5-7
Other:							

STANDING JHA DAILY ADDENDUM		
Additional Tasks, Steps or Tools	Potential Hazards	Mitigation/Elimination Steps
General Shop Work (Using electric and/or pneumatic tools, hand tools, band saw, jack stands, vice etc.)	Lifting Hazards, Back/Muscle Strains	Lift with legs, never your back. Do not twist or overreach. Use additional manpower/device if over 50-lbs.
	Slip, Trip or Fall Hazards	Maintain good housekeeping practices and clear travel paths. Tie off or hold ladders. Maintain 3 points of contact on stairs & ladders. Run cords overhead if possible or red flag/tape down all chords.
	Line of Fire/Pinch Point Hazards	Maintain appropriate space in between employees utilizing hand tools etc. Inspect tools before use, use whip checks & face shield. Maintain proper hand position.
	Cut or Abrasions Hazards from Blades, Bits, Discs etc	Unplug power tools to change disc, bits, blades, adjusting guards or when not in use. Hold tools with both hands-on manufactures designed handles. Do not remove handles/safety guards. Do not place hands on edges of material.
	Materials or Clothing Caught in Rotating Parts of Tools	Keep loose clothing tucked in and/or material secured and away from rotational parts of tools while in use. Have shirt sleeves buttoned.

11	Equipment Calibration
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Specialloy, Inc.
11702 Brittmoore Park Drive
Houston, Texas 77041
(713) 827-7776

Certificate of Calibration

Certificate No. **081728** Transmitter **MT5003076 10 CHANNEL** RESULT: **PASS** Print Date: **2/12/2024**

Unit Under Test(UUT)

UUT ID: **14-1251** Calibration Date: **1/17/2024**
Model: **MT5003076 10 CHANNEL** Expiration Date: **1/17/2025**
Range: **0-50000 psi** Manufacturer: **Specialty Technology**
Resolutions: **0.001V** Customer: **Electronics Testing Services**
Application Site: **25520 BRITTMORE PARKWAY, TX 77041**
Accuracy: **0.15% FS**

Calibration Results

	Result	Max Error	Temperature	Humidity	Atmospheric pressure
As Found	0.14444444	0.17%	24.7	67%	0.9744 Pa
As Left	0.14444444	0.17%	24.7	68%	0.9744 Pa

Calibration Data - As Found

SetPoints	Reference	Nominal	Reference	Tolerance	Deviation	Error
psi	psi	V	V	V	V	(%)
0.00	0.00	0.0000	0.0016	0.0125	0.0046	0.09
6000.00	6000.00	0.5000	0.5006	0.0125	0.0006	0.01
12000.00	12000.00	1.0000	0.9978	0.0125	0.0022	0.04
18000.00	18000.00	1.5000	1.4961	0.0125	0.0039	0.03
24000.00	24000.00	2.0000	1.9954	0.0125	0.0046	0.09
30000.00	30000.00	2.5000	2.4956	0.0125	0.0044	0.09
36000.00	36000.00	3.0000	2.9962	0.0125	0.0038	0.04
42000.00	42000.00	3.5000	3.4994	0.0125	0.0006	0.01
48000.00	48000.00	4.0000	4.0011	0.0125	0.0011	0.02
54000.00	54000.00	4.5000	4.5034	0.0125	0.0034	0.07
60000.00	60000.00	5.0000	5.0058	0.0125	0.0058	0.14
36000.00	36000.00	3.0000	3.0082	0.0125	0.0082	0.16
30000.00	30000.00	2.5000	2.5083	0.0125	0.0083	0.17
24000.00	24000.00	2.0000	2.0081	0.0125	0.0081	0.16
0.00	0.00	0.0000	0.0078	0.0125	0.0078	0.14

www.AsLeftCalibrator - Hi Data Program

Calibration Data - As Left

SetPoints	Reference	Nominal	Reference	Tolerance	Deviation	Error	BFSL	Dev	BFSL Err
psi	psi	V	V	V	V	(%)			(%)
0.00	0.00	0.0000	0.0046	0.0125	0.0046	0.09	0.0028	0.0012	0.077
6000.00	6000.00	0.5000	0.5006	0.0125	0.0006	0.01	0.5010	-0.0034	0.017
12000.00	12000.00	1.0000	0.9978	0.0125	0.0022	0.04	0.9992	0.0014	0.058
18000.00	18000.00	1.5000	1.4961	0.0125	0.0039	0.03	1.4975	0.0014	0.055
24000.00	24000.00	2.0000	1.9954	0.0125	0.0046	0.09	1.9957	0.0003	0.011
30000.00	30000.00	2.5000	2.4956	0.0125	0.0044	0.09	2.4939	0.0017	0.068
36000.00	36000.00	3.0000	2.9962	0.0125	0.0038	0.04			
42000.00	42000.00	3.5000	3.4994	0.0125	0.0006	0.01			
48000.00	48000.00	4.0000	4.0011	0.0125	0.0011	0.02			
54000.00	54000.00	4.5000	4.5034	0.0125	0.0034	0.07			
60000.00	60000.00	5.0000	5.0058	0.0125	0.0058	0.14			
36000.00	36000.00	3.0000	3.0082	0.0125	0.0082	0.16			
30000.00	30000.00	2.5000	2.5083	0.0125	0.0083	0.17			
24000.00	24000.00	2.0000	2.0081	0.0125	0.0081	0.16			
0.00	0.00	0.0000	0.0078	0.0125	0.0078	0.14			

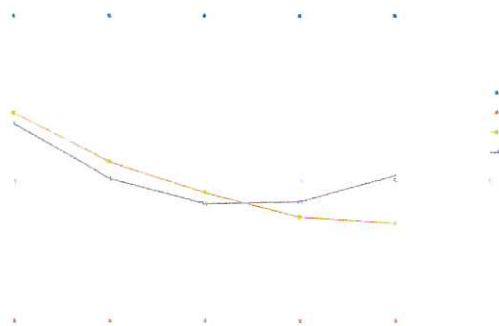
www.AsLeftCalibrator - Hi Data Program

References

Manufacturer	Model	Serial Number	Certificate No.	Due Date	Accuracy	BFSL ERROR: 0.1161
Additel Corporation	AD1000-GR004-PS-A01	21161400017	MT5003076	8/26/2024	0.15%	
Additel Corporation	AD1000A	110418010005	MT5003076	8/26/2024	0.15%	
FAACVIA	600274-170	5110	MT5003076	8/26/2024	1%	

Unit Output
0.004
0.997
1.995
2.996
4.001
5.006

Terminal	BFSL
0.1959	0.1161



[Signature]

We certify the equipment used for this calibration has a test uncertainty ratio of 4:1 or more times greater accuracy than the unit calibrated.
All inspections are traceable to the National Institute of Standards and Technology. The Calibration & Certification
have been performed to Specialloy's Quality & Laboratory Procedures. All Calibration Equipment used per: ANSI/ISO 9001:2015



Specialty Alloy, Inc.
11702 Brittmoore Park Drive
Houston, Texas 77041
(713) 827-7776

Certificate of Calibration

Certificate No.		Transmitter		RESULT: PASS		Print Date	
B11149		MT3003076 10 CHANNEL				7/7/2024	
Unit Under Test (UUT)							
UUT ID:	414224	Calibration Date:	7/7/2024				
Model:	075000-400000-100	Expiration Date:	7/7/2024				
Range:	0-50000psi	Manufacturer:	Adair Test Systems				
Resolution:	0.001psi	Customer:	Measurement Testing Services				
Application Site:	205,000 TON PRESSURE VESSEL						
Accuracy:	0.25% FS						

Calibration Results

	Result	Max Error	Temperature	Humidity	Atmospheric pressure
As Found	0.000000	0.017%	64.4	65%	1.015 MPa
As Left	0.000000	0.017%	64.8	65%	1.015 MPa

Calibration Data - As Found

Self Points	Reference	Nominal	Reference	Tolerance	Deviation	Error	Test Point	Limit	Limit	Self Points	Reference	Nominal	Reference	Tolerance	Deviation	Error	BFSL	Dev	BFSL Err
psi	psi	V	V	V	V	(%)		Max	Min	psi	psi	V	V	V	V	(%)			(%)
0	0	0.0000	0.0000	0.0125	0.0036	0.07	1	0.25	0.25	0	0	0.0000	0.0000	0.0125	0.0016	0.07	0.0014	0.0022	0.088
6000	6000	0.5000	0.4984	0.0125	0.0016	0.03	2	0.25	0.25	6000	6000	0.5000	0.4984	0.0125	0.0016	0.03	0.4991	0.0007	0.029
12000	12000	1.0000	0.9954	0.0125	0.0036	0.09	3	0.25	0.25	12000	12000	1.0000	0.9954	0.0125	0.0036	0.09	0.9968	0.0014	0.058
18000	18000	1.5000	1.4931	0.0125	0.0059	0.14	4	0.25	0.25	18000	18000	1.5000	1.4931	0.0125	0.0059	0.14	1.4946	0.0015	0.059
24000	24000	2.0000	1.9914	0.0125	0.0086	0.17	5	0.25	0.25	24000	24000	2.0000	1.9914	0.0125	0.0086	0.17	1.9923	0.0009	0.035
30000	30000	2.5000	2.4923	0.0125	0.0077	0.15	6	0.25	0.25	30000	30000	2.5000	2.4923	0.0125	0.0077	0.15	2.4900	0.0023	0.092
36000	36000	3.0000	2.9942	0.0125	0.0058	0.12	7	0.25	0.25	36000	36000	3.0000	2.9942	0.0125	0.0058	0.12			
42000	42000	3.5000	3.4976	0.0125	0.0024	0.05	8	0.25	0.25	42000	42000	3.5000	3.4976	0.0125	0.0024	0.05			
48000	48000	4.0000	4.0014	0.0125	0.0014	0.03	9	0.25	0.25	48000	48000	4.0000	4.0014	0.0125	0.0014	0.03			
54000	54000	4.5000	4.5036	0.0125	0.0036	0.09	10	0.25	0.25	54000	54000	4.5000	4.5036	0.0125	0.0036	0.09			
60000	60000	5.0000	5.0055	0.0125	0.0055	0.11	11	0.25	0.25	60000	60000	5.0000	5.0055	0.0125	0.0055	0.11			
66000	66000	5.5000	5.5086	0.0125	0.0086	0.17	12	0.25	0.25	66000	66000	5.5000	5.5086	0.0125	0.0086	0.17			
72000	72000	6.0000	6.0079	0.0125	0.0079	0.16	13	0.25	0.25	72000	72000	6.0000	6.0079	0.0125	0.0079	0.16			
78000	78000	6.5000	6.5079	0.0125	0.0079	0.16	14	0.25	0.25	78000	78000	6.5000	6.5079	0.0125	0.0079	0.16			
84000	84000	7.0000	7.0000	0.0125	0.0000	0.00	15	0.25	0.25	84000	84000	7.0000	7.0000	0.0125	0.0000	0.00			

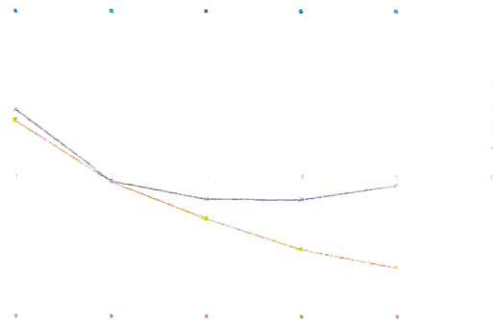
*** As Found Calibration Data End ***

*** As Left Calibration Data End ***

References

Manufacturer	Model	Serial Number	Certificate No.	Due Date	Accuracy	BFSL ERROR: 0.1409
Adair Corporation	AD1651 10-Channel PSIA/AS	01-08-99-D0017	112692745	7/26/2024	0.15%	
Adair Corporation	AD1112A	01-08-180-D0001	112692702	7/26/2024	0.01%	
FAIRVIEW	800214-070	5110	9075233	7/11/2024	0.01%	

Unit Output	
0.003	
0.666	
1.991	
2.994	
4.001	
6.005	
Terminal	BFSL
0.2556	0.1409



[Signature]

Inspector:
We certify the equipment used for this calibration has a test uncertainty ratio of 4:1 or more times greater accuracy than the unit calibrated.
All inspections are traceable to the National Institute of Standards and Technology. The Calibration & Certifications
have been performed to Specialty Alloy's Quality & Laboratory Procedures. All calibration equipment used per ASTM/E650-1-1994.



Specialloy, Inc.
11702 Brittmoore Park Drive
Houston, Texas 77041
(713) 827-7776

Certificate of Calibration

Transmitter

Certificate No. 011724-4 RESULT: PASS Print Date 07/17/2024

Unit Under Test (UUT)

UUT ID: 1415244
Model: Q77300400002-103
Range: 0-40000 PSI
Resolution: 0.001 PSI
Application Site: 23520 JONES RD WILLOWBROOK, IL 60094
Accuracy: 0.25% FS

Calibration Date: 07/17/2024
Expiration Date: 07/17/2025
Manufacturer: Specialloy, Inc.
Customer: Neurochemical Testing Services

Calibration Results

	Result	Max Error	Temperature	Humidity	Atmospheric pressure
As Found	In Tolerance	0.25 %	62°F	65%	1015 hPa
As Left	In Tolerance	0.25 %	64°F	69%	1015 hPa

Calibration Data - As Found

Max Error: 0.25 %						
Set Points	Reference	Nominal	Reference	Tolerance	Deviation	Error
psi	psi	V	V	V	V	(%)
0	0	0.000	0.0053	0.0125	0.0053	0.11
6000	6000	0.5000	0.5006	0.0125	0.0006	0.01
12000	12000	1.0000	0.9972	0.0125	-0.0028	-0.06
18000	18000	1.5000	1.4959	0.0125	-0.0041	-0.08
24000	24000	2.0000	1.9952	0.0125	-0.0048	-0.10
30000	30000	2.5000	2.4950	0.0125	-0.0050	-0.10
36000	36000	3.0000	2.9974	0.0125	-0.0026	-0.05
42000	42000	3.5000	3.5002	0.0125	0.0002	0.00
48000	48000	4.0000	4.0025	0.0125	0.0025	0.05
54000	54000	4.5000	4.5097	0.0125	0.0097	0.19
60000	60000	5.0000	5.0125	0.0125	0.0125	0.25
36000	36000	3.0000	3.0122	0.0125	0.0122	0.24
30000	30000	2.5000	2.5123	0.0125	0.0123	0.25
24000	24000	2.0000	2.0121	0.0125	0.0121	0.24
0	0	0.0000	0.0046	0.0125	0.0046	0.09

www.as-found-calibration-data-end-view

Calibration Data - As Left

Max Error: 0.25 %						
Test Point	Unit	Limit	Set Points	Reference	Nominal	Reference
	Max	Min	psi	psi	V	V
1	0.25	0.15	0	0	0.0000	0.0053
2	0.25	0.15	6000	6000	0.5000	0.5006
3	0.25	0.15	12000	12000	1.0000	0.9972
4	0.25	0.15	18000	18000	1.5000	1.4959
5	0.25	0.15	24000	24000	2.0000	1.9952
6	0.25	0.15	30000	30000	2.5000	2.4950
7	0.25	0.15	36000	36000	3.0000	2.9974
8	0.25	0.15	42000	42000	3.5000	3.5002
9	0.25	0.15	48000	48000	4.0000	4.0025
10	0.25	0.15	54000	54000	4.5000	4.5097
11	0.25	0.15	60000	60000	5.0000	5.0125
12	0.25	0.15	36000	36000	3.0000	3.0122
13	0.25	0.15	30000	30000	2.5000	2.5123
14	0.25	0.15	24000	24000	2.0000	2.0121
15	0.25	0.15	0	0	0.0000	0.0046

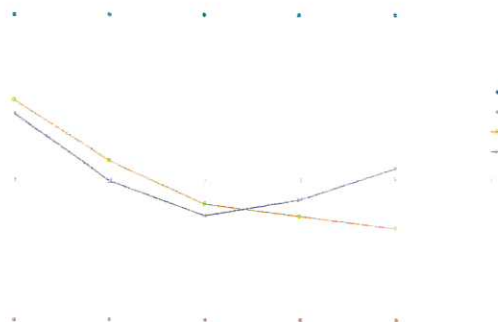
www.as-left-calibration-data-end-view

References

Manufacturer	Model	Serial Number	Certificate No.	Due Date	Accuracy
Arister Corporation	ADT501-10-GPa01-PS-1A1	21101-9920017	102097745	04/26/2024	0.1345
Arister Corporation	ADT1224	51741-6010005	102397202	04/24/2024	0.015
FALEND	6002T427D	51110	9026234	04/11/2024	0%

BFSL ERROR: 0.1474

Unit Output	
0.005	
0.997	
1.995	
2.997	
4.002	
5.012	
Terminal	BFSL
0.2556	0.1474



[Signature]

Specialloy
We certify the equipment used for this calibration has a test uncertainty ratio of 4:1 or more times greater accuracy than the unit calibrated.
All inspections are traceable to the National Institute of Standards and Technology. The Calibration & Certification
have been performed to Specialloy's Quality & Laboratory Procedures. All Calibration Equipment used per ASTM E 1360-1, 1994



Specialloy, Inc.
11702 Brittmoore Park Drive
Houston, Texas 77041
(713) 827-7776

Certificate of Calibration

Transmitter

Certificate No. 0817248 RESULT: PASS Print Date 10/1/2024

Unit Under Test(UUT)

UUT ID: 1410245
Model: 4375-003-400002-100
Range: 10+80000psi
Resolution: 0.001psi
Application Site: 25529 PONES REVALUER TX 77064
Accuracy: 0.1015%

Calibration Date: 9/15/2024
Expiration Date: 9/15/2025
Manufacturer: Specialloy Instrumentation
Customer: Mechanical Testing Services

Calibration Results

	Result	Max Error	Temperature	Humidity	Atmospheric pressure
As Found	in tolerance	0.14%	42°F	65%	1.015 inHg
As Left	in tolerance	0.24%	54°F	35%	1.015 inHg

Calibration Data - As Found

Max Error 0.24%										Calibration Data - As Left										Max Error 0.24%			
SetPoints	Reference	Nominal	Reference	Tolerance	Deviation	Error	Test Point	Limit	Limit	SetPoints	Reference	Nominal	Reference	Tolerance	Deviation	Error	BFSL	Dev	BFSL	Err			
psi	psi	V	V	V	V	(%)		Max	Min	psi	psi	V	V	V	V	(%)							
0	0	0.0000	0.0023	0.0125	0.0023	0.05	1	0.25	0.25	0	0	0.0000	0.0023	0.0125	0.0023	0.05	0.0003	0.0020	0.041				
6000	6000	0.5000	0.4988	0.0125	0.0012	0.02	2	0.25	0.25	6000	6000	0.5000	0.4988	0.0125	0.0012	-0.02	0.4994	0.0006	0.024				
12000	12000	1.0000	0.9969	0.0125	0.0031	0.06	3	0.25	0.25	12000	12000	1.0000	0.9969	0.0125	0.0031	0.06	0.9985	0.0016	0.065				
18000	18000	1.5000	1.4965	0.0125	0.0035	0.07	4	0.25	0.25	18000	18000	1.5000	1.4965	0.0125	-0.0035	-0.07	1.4977	0.0012	0.047				
24000	24000	2.0000	1.9963	0.0125	0.0037	0.07	5	0.25	0.25	24000	24000	2.0000	1.9963	0.0125	0.0037	0.07	1.9968	0.0005	0.020				
30000	30000	2.5000	2.4978	0.0125	0.0022	0.04	6	0.25	0.25	30000	30000	2.5000	2.4978	0.0125	0.0022	0.04	2.4950	0.0019	0.075				
36000	36000	3.0000	3.0005	0.0125	0.0005	0.01	7	0.25	0.25	36000	36000	3.0000	3.0005	0.0125	0.0005	0.01							
42000	42000	3.5000	3.5045	0.0125	0.0045	0.09	8	0.25	0.25	42000	42000	3.5000	3.5045	0.0125	0.0045	0.09							
48000	48000	4.0000	4.0052	0.0125	0.0052	0.10	9	0.25	0.25	48000	48000	4.0000	4.0052	0.0125	0.0052	0.10							
54000	54000	4.5000	4.5064	0.0125	0.0064	0.13	10	0.25	0.25	54000	54000	4.5000	4.5064	0.0125	0.0064	0.13							
60000	60000	5.0000	5.0079	0.0125	0.0079	0.16	11	0.25	0.25	60000	60000	5.0000	5.0079	0.0125	0.0079	0.16							
36000	36000	3.0000	3.0120	0.0125	0.0120	0.24	12	0.25	0.25	36000	36000	3.0000	3.0120	0.0125	0.0120	0.24							
30000	30000	2.5000	2.5111	0.0125	0.0111	0.22	13	0.25	0.25	30000	30000	2.5000	2.5111	0.0125	0.0111	0.22							
24000	24000	2.0000	2.0100	0.0125	0.0100	0.20	14	0.25	0.25	24000	24000	2.0000	2.0100	0.0125	0.0100	0.20							
0	0	0.0000	0.0043	0.0125	0.0043	0.09	15	0.25	0.25	0	0	0.0000	0.0043	0.0125	0.0043	0.09							

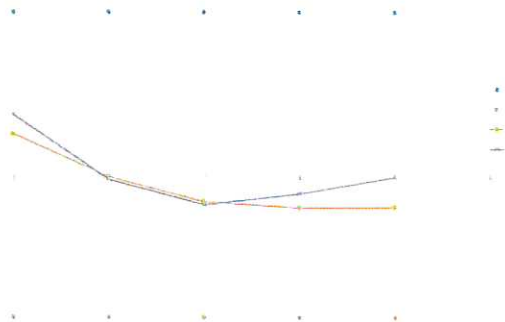
*** As Found Calibration Data End ***

*** As Left Calibration Data End ***

References

Manufacturer	Model	Serial Number	Certificate No.	Due Date	Accuracy	BFSL ERROR: 0.0771
A. Hibel Corporation	AD1001-10-07601-PH-AVI	2118-9900017	1123072745	9/16/2024	0.1585	
A. Hibel Corporation	AD11001	4174-8010001	1123072702	9/16/2024	0.0115	
Kalco Inc	800274270	5-110	9025_233	9/11/2024	1%	

Unit Output	
0.002	
0.996	
1.996	
3.005	
4.005	
5.007	
Terminal	BFSL
0.1558	0.0921



[Signature]

Inspector
We certify the equipment used for this calibration has a test uncertainty ratio of 4:1 or more times greater accuracy than the unit is calibrated.
All inspections are traceable to the National Institute of Standards and Technology. The Calibration & Certifications
have been performed to Specialloy's Quality & Laboratory Procedures. All Calibration Equipment used per AD15/16-51-250-1-1934



Specialloy, Inc.
11702 Brittmoore Park Drive
Houston, Texas 77041
(713) 827-7776

Certificate of Calibration

Certificate No. 0117246 Transmitter MTS003076 10 CHANNEL RESULT: PASS Print Date 07/26/2024

Unit Under Test(UUT)

UUT ID: 415246
Model: 070200-0000-10-
Range: 0-20000psi
Resolution: 0.001psi
Application Site: 20520-0000-0000-10-0000
Accuracy: 0.25% FS

Calibration Date: 07/26/2024
Expiration Date: 07/26/2025
Manufacturer: Specialloy, Inc.
Customer: Mechanical Testing Services

Calibration Results

	Result	Max Error	Temperature	Humidity	Atmospheric pressure
As Found	in tolerance	0.24 %	64.1 F	95%	1015 hPa
As Left	in tolerance	0.24 %	64.1 F	95%	1015 hPa

Calibration Data - As Found

Calibration Data - As Found							Calibration Data - As Left									
Max Error: 0.24 %							Max Error: 0.21 %									
Set Points	Reference	Nominal	Reference	Tolerance	Deviation	Error	Test Point	Limit	Limit	Set Points	Reference	Nominal	Reference	Tolerance	Deviation	Error
psi	psi	V	V	V	V	(%)	psi	Max	Min	psi	psi	V	V	V	V	(%)
0	0	0.0000	0.0000	0.0125	0.0000	0.00	1	0.25	0.25	0	0	0.0000	0.0000	0.0125	0.0000	0.00
6000	6000	0.5000	0.4980	0.0125	-0.0020	-0.04	2	0.25	0.25	6000	6000	0.5000	0.4980	0.0125	-0.0020	-0.04
12000	12000	1.0000	0.9999	0.0125	-0.0001	-0.12	3	0.25	0.25	12000	12000	1.0000	0.9999	0.0125	-0.0001	-0.07
18000	18000	1.5000	1.4997	0.0125	-0.0003	-0.18	4	0.25	0.25	18000	18000	1.5000	1.4997	0.0125	-0.0003	-0.18
24000	24000	2.0000	1.9992	0.0125	-0.0008	-0.22	5	0.25	0.25	24000	24000	2.0000	1.9992	0.0125	-0.0008	-0.22
30000	30000	2.5000	2.4878	0.0125	-0.0122	-0.24	6	0.25	0.25	30000	30000	2.5000	2.4878	0.0125	-0.0122	-0.24
36000	36000	3.0000	2.9886	0.0125	-0.0114	-0.23	7	0.25	0.25	36000	36000	3.0000	2.9886	0.0125	-0.0114	-0.23
42000	42000	3.5000	3.4891	0.0125	-0.0109	-0.22	8	0.25	0.25	42000	42000	3.5000	3.4891	0.0125	-0.0109	-0.22
48000	48000	4.0000	3.9932	0.0125	-0.0068	-0.14	9	0.25	0.25	48000	48000	4.0000	3.9932	0.0125	-0.0068	-0.14
54000	54000	4.5000	4.4940	0.0125	-0.0060	-0.12	10	0.25	0.25	54000	54000	4.5000	4.4940	0.0125	-0.0060	-0.12
60000	60000	5.0000	4.9977	0.0125	-0.0023	-0.05	11	0.25	0.25	60000	60000	5.0000	4.9977	0.0125	-0.0023	-0.05
36000	36000	3.0000	3.0042	0.0125	0.0042	0.08	12	0.25	0.25	36000	36000	3.0000	3.0042	0.0125	0.0042	0.08
30000	30000	2.5000	2.5049	0.0125	0.0049	0.10	13	0.25	0.25	30000	30000	2.5000	2.5049	0.0125	0.0049	0.10
24000	24000	2.0000	2.0057	0.0125	0.0057	0.11	14	0.25	0.25	24000	24000	2.0000	2.0057	0.0125	0.0057	0.11
0	0	0.0000	0.0075	0.0125	0.0075	0.15	15	0.25	0.25	0	0	0.0000	0.0075	0.0125	0.0075	0.15

*** As Found Calibration Data Error ***

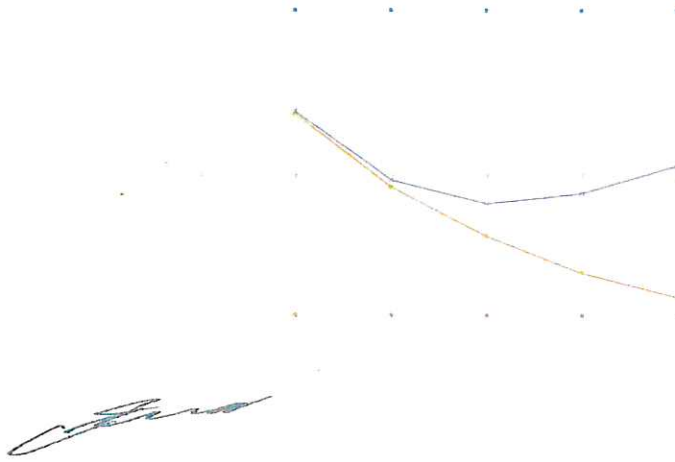
*** As Left Calibration Data Error ***

References

Manufacturer	Model	Serial Number	Certificate No.	Due Date	Accuracy
AdiSteel Corporation	ADSteel-10-07-04-PS-AV	21181900017	020092745	9/26/2024	0.15%
AdiSteel Corporation	ADSteel	317418010005	020092702	9/26/2024	0.01%
FALEVAL	800214370	5110	5025238	9/11/2024	1%

BFSL ERROR: 0.022

Unit Output	
0.003	
0.693	
1.692	
2.588	
3.693	
4.697	
Terminal	BFSL
0.3724	0.2205



Inspector: [Signature]
We certify the equipment used for this calibration has a test uncertainty ratio of 4:1 or more times greater accuracy than the unit calibrated.
All inspections are traceable to the National Institute of Standards and Technology. The Calibration & Certifications have been performed to Specialloy's Quality & Laboratory Procedures. All Calibration Equipment used per NIST/NCS 7540-1:1994



Transmitter				
Certificate No.	0170247	MTSC03076 10 CHANNEL	RESULT: PASS	Print Date 12/20/2024
Unit Under Test(UUT)				
UUT ID :	14-6247	Calibration Date:	11/17/2024	
Model:	MTSC000-6000005-10x	Expiration Date:	11/17/2025	
Range:	0-40000 Hz	Manufacturer:	Shooker Technology	
Resolution:	0.001 Hz	Customer:	Mechanical Testing Services	
Application Site:	76520 STAINLESS STEEL BALL IN STAINLESS			
Accuracy:	0.25%, 5%			
Calibration Results				
	Result	Max Error	Temperature	Humidity
As Found	1.145 Hz	0.25 %	58°F	76%
As Left	1.146 Hz	0.25 %	58°F	76%
				Atmospheric pressure
				1.015 kPa
				1.015 kPa

Calibration Data - As Left

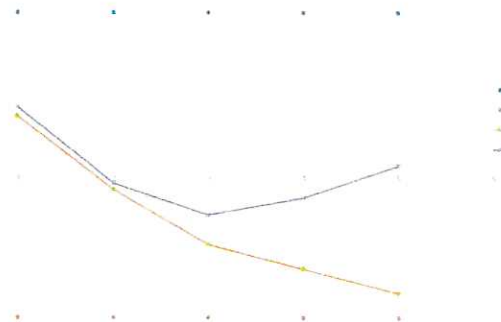
Max Error: 0.25%										Max Error: 0.25%											
Set	Points	Reference	Nominal	Reference	Tolerance	Deviation	Error (%)	Test Point	Limit Max	Limit Min	Set	Points	Reference	Nominal	Reference	Tolerance	Deviation	Error (%)	BFSL	Dev	BFSL Err
psi	psi	v	v	v	v	v	(%)				psi	psi	v	v	v	v	(%)			(%)	
0	0	0.0000	0.0040	0.0175	0.0040	0.08		1	0.25	-0.25	0	0	0.0000	0.0040	0.0125	0.0040	0.08	0.0016	0.0024	0.095	
6000	6000	0.5000	0.4979	0.0125	-0.0021	0.04		2	0.25	-0.25	6000	6000	0.5000	0.4979	0.0125	0.0021	-0.04	0.4086	0.0070	-0.030	
12000	12000	1.0000	0.9936	0.0125	-0.0064	0.13		3	0.25	-0.25	12000	12000	1.0000	0.9936	0.0125	-0.0064	0.13	0.9956	0.0020	-0.062	
18000	18000	1.5000	1.4913	0.0125	-0.0087	0.17		4	0.25	-0.25	18000	18000	1.5000	1.4913	0.0125	-0.0087	0.17	1.4926	0.0013	-0.054	
24000	24000	2.0000	1.9906	0.0125	-0.0094	0.21		5	0.25	-0.25	24000	24000	2.0000	1.9906	0.0125	-0.0094	0.21	1.9896	0.0000	-0.001	
30000	30000	2.5000	2.4884	0.0125	-0.0116	0.23		6	0.25	-0.25	30000	30000	2.5000	2.4884	0.0125	-0.0116	0.23	2.4866	-0.0018	-0.072	
36000	36000	3.0000	2.9910	0.0125	-0.0090	0.18		7	0.25	-0.25	36000	36000	3.0000	2.9910	0.0125	-0.0090	0.18				
42000	42000	3.5000	3.4916	0.0125	-0.0084	0.17		8	0.25	-0.25	42000	42000	3.5000	3.4916	0.0125	-0.0084	0.17				
48000	48000	4.0000	3.9942	0.0125	-0.0058	0.12		9	0.25	-0.25	48000	48000	4.0000	3.9942	0.0125	-0.0058	0.12				
54000	54000	4.5000	4.5011	0.0125	0.0011	0.02		10	0.25	-0.25	54000	54000	4.5000	4.5011	0.0125	0.0011	0.02				
60000	60000	5.0000	5.0013	0.0125	0.0013	0.03		11	0.25	-0.25	60000	60000	5.0000	5.0013	0.0125	0.0013	0.03				
36000	36000	3.0000	3.0059	0.0125	0.0059	0.12		12	0.25	-0.25	36000	36000	3.0000	3.0059	0.0125	0.0059	0.12				
30000	30000	2.5000	2.5064	0.0125	0.0064	0.13		13	0.25	-0.25	30000	30000	2.5000	2.5064	0.0125	0.0064	0.13				
24000	24000	2.0000	2.0073	0.0125	0.0073	0.15		14	0.25	-0.25	24000	24000	2.0000	2.0073	0.0125	0.0073	0.15				
0	0	0.0000	0.0086	0.0125	0.0086	0.17		15	0.25	-0.25	0	0	0.0000	0.0086	0.0125	0.0086	0.17				

As List's condition is $\exists$ data end, we

Manufacturer	Model	Serial Number	Certificate No.	Exp. Date	Accuracy
Adiplex Corporation	ADP681-10-0250-PS-AM	2118199E2017	h13072745	9/26/2024	0.15%
Adiplex Corporation	ADP10024	917418010000	h13072750	9/24/2024	0.01%
FAU5614	u002714270	5-110	9016293	9/11/2024	1%

Unit Output
0.004
0.993
1.989
2.991
3.994
5.001

Terminal	BFS
0.2762	0.159



We certify the equipment used for this calibration has a test uncertainty ratio of 1.1 or more times greater accuracy than the unit calibrated. All inspections are traceable to the National Institute of Standards and Technology. The Calibration & Certifications have been performed to Specialty's Quality & Laboratory Procedures. All Calibration Equipment used per MISO/NSL 25-30.1, 1994.



Specialloy, Inc.
11702 Brittmoore Park Drive
Houston, Texas 77041
(713) 827-7776

Certificate of Calibration

Transmitter

Certificate No.	0817248	MTS003075 10 CHANNEL	RESULT: PASS	Print Date	08/17/2024
Unit Under Test(UUT)					
UUT ID :	14-1574	Calibration Date:	07/17/2024		
Model:	ADT500-50000-PSI-AM	Expiration Date:	07/17/2025		
Range:	0-50000 psi	Manufacturer:	Stellar Technology		
Resolution:	0.001V	Customer:	Electronics Testing Services		
Application Site:	205.09 30x63 10VVA, 27 14 72484				
Accuracy:	± 0.25 % FS				

Calibration Results

	Result	Max Error	Temperature	Humidity	Atmospheric pressure
As Found	in Reference	0.24 %	84°F	39%	1015 kPa
As Left	in Reference	0.24 %	84°F	39%	1015 kPa

Calibration Data - As Found

Map Error: 0.24 %										Total Error: 0.24 %											
SetPoints	Reference	Nominal	Reference	Tolerance	Deviation	Error		Test Point	Unit	Limit	SetPoints	Reference	Nominal	Reference	Tolerance	Deviation	Error		BFSL	Dev	BFSL Err
psi	psi	V	V	V	V	(%)		psi	Max	Min	psi	psi	V	V	V	V	(%)				
0	0	0.0000	0.0007	0.0125	0.0057	0.11		1	0.25	0.25	0	0	0.0000	0.0057	0.0125	0.0057	0.11	0.0044	0.0011	0.051	
6000	6000	0.5000	0.5017	0.0125	0.0017	0.03		2	0.25	0.25	1000	6000	0.5000	0.5017	0.0125	0.0017	0.03	0.5013	0.0004	0.015	
12000	12000	1.0000	0.9967	0.0125	0.0033	0.07		3	0.25	0.25	12000	12000	1.0000	0.9967	0.0125	0.0033	0.07	0.9982	-0.0015	0.062	
18000	18000	1.5000	1.4938	0.0125	0.0062	0.12		4	0.25	0.25	18000	18000	1.5000	1.4938	0.0125	0.0062	0.12	1.4952	-0.0048	0.056	
24000	24000	2.0000	1.9911	0.0125	0.0086	0.17		5	0.25	0.25	24000	24000	2.0000	1.9911	0.0125	0.0086	0.17	1.9921	-0.0079	0.079	
30000	30000	2.5000	2.4910	0.0125	0.0090	0.18		6	0.25	0.25	30000	30000	2.5000	2.4910	0.0125	0.0090	0.18	2.4891	-0.0109	0.078	
36000	36000	3.0000	2.9905	0.0125	0.0095	0.19		7	0.25	0.25	36000	36000	3.0000	2.9905	0.0125	0.0095	0.19				
42000	42000	3.5000	3.4940	0.0125	0.0060	0.12		8	0.25	0.25	42000	42000	3.5000	3.4940	0.0125	0.0060	0.12				
48000	48000	4.0000	3.9958	0.0125	0.0042	0.08		9	0.25	0.25	48000	48000	4.0000	3.9958	0.0125	0.0042	0.08				
54000	54000	4.5000	4.4978	0.0125	0.0022	0.04		10	0.25	0.25	54000	54000	4.5000	4.4978	0.0125	0.0022	0.04				
60000	60000	5.0000	5.0012	0.0125	0.0012	0.02		11	0.25	0.25	60000	60000	5.0000	5.0012	0.0125	0.0012	0.02				
66000	66000	5.5000	5.5004	0.0125	0.0004	0.01		12	0.25	0.25	66000	66000	5.5000	5.5004	0.0125	0.0004	0.01				
72000	72000	6.0000	6.0087	0.0125	0.0087	0.17		13	0.25	0.25	72000	72000	6.0000	6.0087	0.0125	0.0087	0.17				
78000	78000	6.5000	6.5099	0.0125	0.0099	0.20		14	0.25	0.25	78000	78000	6.5000	6.5099	0.0125	0.0099	0.20				
84000	84000	7.0000	7.0105	0.0125	0.0105	0.21		15	0.25	0.25	84000	84000	7.0000	7.0105	0.0125	0.0105	0.21				
90000	90000	7.5000	7.5121	0.0125	0.0121	0.24		16	0.25	0.25	90000	90000	7.5000	7.5121	0.0125	0.0121	0.24				

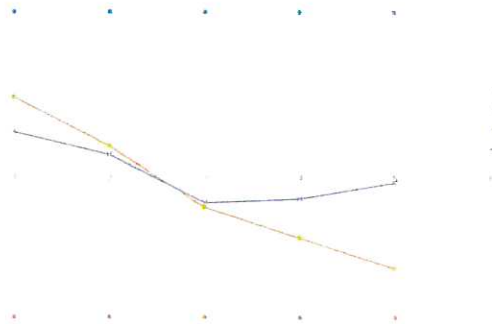
As Found Generation Data End Here

As Left Generation Data End Here

References

Manufacturer	Model	Serial Number	Certificate No.	Due Date	Accuracy	BFSL ERROR: 0.1392
Aditel Corporation	ADT500-50000-PSI-AM	2116199000-1	0817248	9/26/2024	0.1392	
Aditel Corporation	ADT1000	0174-8010005	08092000	9/24/2024	0.0015	
FAE Inc.	500011270	3-110	0010134	9/11/2024	0.0	

Unit Output	
0.005	
0.666	
1.661	
2.99	
3.995	
5.001	
Terminal	BFSL
0.2522	0.1392



[Signature]

Specialloy
We certify the equipment used for this calibration has a test uncertainty ratio of 4:1 or more times greater accuracy than the unit calibrated.
All inspections are traceable to the National Institute of Standards and Technology. The Calibration & Certification
have been performed to Specialloy's Quality & Laboratory Procedures. All Calibration Equipment used per ANSI/NCSL Z540-1:1994.



Specialloy, Inc.
11702 Brittmoore Park Drive
Houston, Texas 77041
(713) 827-7776

Certificate of Calibration

Certificate No.		Transmitter		RESULT: PASS	Print Date
19011249		MTS003076 10-CHANNEL			10/26/2024
Unit Under Test(UUT)					
UUT ID:	14-4241	Calibration Date:	10/26/2024		
Model:	Q75200-60000G-100	Expiration Date:	10/26/2025		
Range:	0-60000 psi	Manufacturer:	Stewart Technology		
Resolution:	0.001	Customer:	Specialloy, Inc. Testing Laboratory		
Application Site:	20520 Brittmoore Park Drive, Houston, TX 77041				
Accuracy:	0.25% FS				

Calibration Results

	Result	Max Error	Temperature	Humidity	Atmospheric pressure
As Found	in tolerance	0.25 %	85°F	95%	14.724 PSI
As Left	in tolerance	0.25 %	86°F	96%	14.714 PSI

Calibration Data - As Found

						Calibration Data - As Left									
						Max Error: 0.25 %									
Set Points	Reference	Nominal	Reference	Tolerance	Deviation	Max Error: 0.25 %									
psi	psi	V	V	V	V	Test Point	Limit	Limit	Set Points	Reference	Nominal	Reference	Tolerance	Deviation	Error
							Max	Min	psi	psi	V	V	V	V	(%)
0	0	0.0000	0.0007	0.0125	0.0007	1	0.25	0.25	0	0	0.0000	0.0007	0.0125	0.0007	0.0037
6000	6000	0.5000	0.4951	0.0125	0.0049	2	0.25	0.25	6000	6000	0.5000	0.4951	0.0125	0.0049	0.175
12000	12000	1.0000	0.9914	0.0125	0.0086	3	0.25	0.25	12000	12000	1.0000	0.9914	0.0125	0.0086	0.003
18000	18000	1.5000	1.4892	0.0125	0.0108	4	0.25	0.25	18000	18000	1.5000	1.4892	0.0125	0.0108	0.114
24000	24000	2.0000	1.9877	0.0125	0.0123	5	0.25	0.25	24000	24000	2.0000	1.9877	0.0125	0.0123	0.161
30000	30000	2.5000	2.4983	0.0125	0.0017	6	0.25	0.25	30000	30000	2.5000	2.4983	0.0125	0.0017	0.179
36000	36000	3.0000	2.9921	0.0125	0.0079	7	0.25	0.25	36000	36000	3.0000	2.9921	0.0125	0.0079	0.16
42000	42000	3.5000	3.4933	0.0125	0.0067	8	0.25	0.25	42000	42000	3.5000	3.4933	0.0125	0.0067	0.13
48000	48000	4.0000	3.9981	0.0125	0.0019	9	0.25	0.25	48000	48000	4.0000	3.9981	0.0125	0.0019	0.04
54000	54000	4.5000	4.5021	0.0125	0.0021	10	0.25	0.25	54000	54000	4.5000	4.5021	0.0125	0.0021	0.04
60000	60000	5.0000	5.0055	0.0125	0.0055	11	0.25	0.25	60000	60000	5.0000	5.0055	0.0125	0.0055	0.11
36000	36000	3.0000	3.0061	0.0125	0.0061	12	0.25	0.25	36000	36000	3.0000	3.0061	0.0125	0.0061	0.12
30000	30000	2.5000	2.5066	0.0125	0.0066	13	0.25	0.25	30000	30000	2.5000	2.5066	0.0125	0.0066	0.13
24000	24000	2.0000	2.0051	0.0125	0.0051	14	0.25	0.25	24000	24000	2.0000	2.0051	0.0125	0.0051	0.10
0	0	0.0000	0.0014	0.0125	0.0014	15	0.25	0.25	0	0	0.0000	0.0014	0.0125	0.0014	0.01

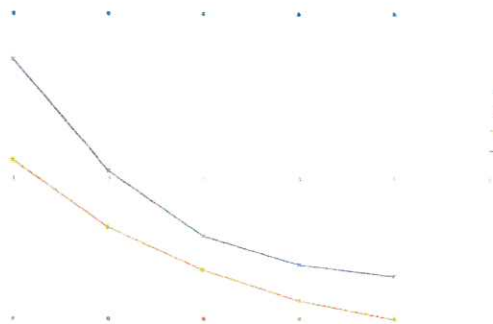
*** As Found Calibration Data Ends ***

*** As Left Calibration Data Ends ***

References

Manufacturer	Model	Serial Number	Certificate No.	Due Date	Accuracy	BFSL ERROR: 0.1627
Additel Corporation	ADT6B1-104Q7604-PS-A101	21191900017	1126977745	9/26/2024	0.15%	
Additel Corporation	ADT6B1-A	3174-PS10038	1126977702	9/26/2024	0.01%	
Fluke	4002T14270	4110	90261291	9/11/2024	1%	

Unit Output	
0	
0.991	
1.987	
2.982	
3.978	
4.975	
5.005	
Terminal BFSL	
0.2697	0.1627



[Signature]

Specialloy
We certify the equipment used for this calibration has a test uncertainty ratio of 4:1 or more times greater accuracy than the unit calibrated.
All inspections are traceable to the National Institute of Standards and Technology. The Calibration & Certification
have been performed to Specialloy's Quality & Laboratory Procedures. All Calibration Equipment used per ANSI/NIST Z39.1-1994



Specialloy, Inc.
11702 Brittmoore Park Drive
Houston, Texas 77041
(713) 827-7776

Certificate of Calibration

Transmitter

Certificate No. 00117440 MT5003076 10 CHANNEL RESULT: PASS Print Date 11/17/2024

Unit Under Test(UUT)

UUT ID: 1415242 Calibration Date: 11/17/2024
Model: MT5003076-10-0012-120 Expiration Date: 11/17/2025
Range: 0-60000psi Manufacture: Special Alloy
Resolution: 0.001psi Customer: Mechanical Testing Service
Application Site: 20520 SHAW EXHIBITION CENTER
Accuracy: 0.25% FS

Calibration Results

	Result	Max Error	Temperature	Humidity	Atmospheric pressure
As Found	in tolerance	0.25%	86°F	98%	1015.47 hPa
As Left	in tolerance	0.25%	86°F	98%	1014.47 hPa

Calibration Data - As Found

SetPoints	Reference	Nominal	Reference	Tolerance	Deviation	Error
psi	psi	V	V	V	V	(%)
0	0	0.0000	0.0059	0.0125	0.0099	0.12
5000	5000	0.5000	0.4998	0.0125	0.0002	0.00
10000	10000	1.0000	0.9990	0.0125	0.0060	0.12
15000	15000	1.5000	1.4910	0.0125	-0.0090	0.18
20000	20000	2.0000	1.9887	0.0125	-0.0113	-0.23
25000	25000	2.5000	2.4877	0.0125	-0.0123	-0.25
30000	30000	3.0000	2.9878	0.0125	-0.0122	-0.24
35000	35000	3.5000	3.4889	0.0125	-0.0111	-0.22
40000	40000	4.0000	3.9970	0.0125	-0.0070	-0.14
45000	45000	4.5000	4.4960	0.0125	-0.0040	-0.08
50000	50000	5.0000	4.9978	0.0125	-0.0022	-0.04
55000	55000	5.5000	5.4937	0.0125	-0.0037	-0.07
60000	60000	6.0000	5.9956	0.0125	-0.0056	-0.11
65000	65000	6.5000	6.4963	0.0125	-0.0063	-0.13
0	0	0.0000	0.0088	0.0125	0.0088	0.18

*** As Found Calibration Data End ***

Calibration Data - As Left

SetPoints	Reference	Nominal	Reference	Tolerance	Deviation	Error	BFSL	Dev	BFSL Err
psi	psi	V	V	V	V	(%)			(%)
0	0	0.0000	0.0059	0.0125	0.0099	0.12	0.0036	0.0023	0.092
5000	5000	0.5000	0.4998	0.0125	0.0002	0.00	0.5000	0.0002	0.007
10000	10000	1.0000	0.9990	0.0125	0.0060	0.12	0.9963	0.0023	0.094
15000	15000	1.5000	1.4910	0.0125	-0.0090	0.18	1.4927	0.0017	0.088
20000	20000	2.0000	1.9887	0.0125	-0.0113	-0.23	1.9891	0.0004	0.015
25000	25000	2.5000	2.4877	0.0125	-0.0123	-0.25	2.4854	0.0021	0.092
30000	30000	3.0000	2.9878	0.0125	-0.0122	-0.24			
35000	35000	3.5000	3.4889	0.0125	-0.0111	-0.22			
40000	40000	4.0000	3.9970	0.0125	-0.0070	-0.14			
45000	45000	4.5000	4.4960	0.0125	-0.0040	-0.08			
50000	50000	5.0000	4.9978	0.0125	-0.0022	-0.04			
55000	55000	5.5000	5.4937	0.0125	-0.0037	-0.07			
60000	60000	6.0000	5.9956	0.0125	-0.0056	-0.11			
65000	65000	6.5000	6.4963	0.0125	-0.0063	-0.13			
0	0	0.0000	0.0088	0.0125	0.0088	0.18			

*** As Left Calibration Data End ***

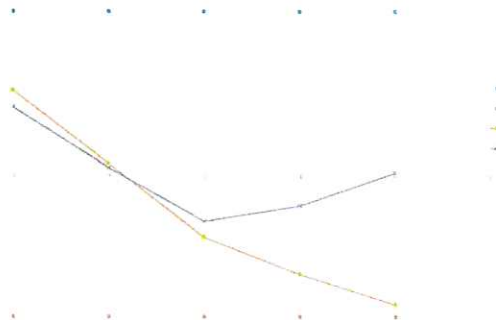
References

Manufacturer	Model	Serial Number	Certificate No.	Due Date	Accuracy
Adel Corporation	ADT61-10-07600-PS-A01	21-81790007	1115087745	9/26/2024	0.125%
Adel Corporation	ADT377A	307A1801005	1115072750	9/14/2024	0.125%
FAIRCHILD	6002T4270	5-110	5025233	9/17/2024	1%

BFSL ERROR: 0.1622

Unit Output
0.005
0.994
1.988
2.987
3.998
4.997

Terminal	BFSL
0.2754	0.1622



[Signature]

Witness:
We certify the equipment used for this calibration has a best uncertainty ratio of 4:1 or more times greater accuracy than the unit calibrated.
All inspections are traceable to the National Institute of Standards and Technology. The Calibration & Certifications
have been performed to Specialloy's Quality & Laboratory Procedures. All Calibration Equipment used per NIST/ISO 9001:2015.



Transmitter			
Certificate No.	100176044	MT003076 10 CHANNEL	RESULT: PASS
Print Date	11/17/2024		
Unit Under Test(UUT)			
UUT ID:	100176044	Calibration Date:	7/16/2024
Model:	MT003076 10 CHANNEL	Expiration Date:	11/18/2026
Range:	0.000000 to 1.000000	Manufacturer:	Shenjie Technology
Resolution:	0.000001	Customer:	Metatron Calibration Services
Application Site:	20520 (Tongji) Street, LFP, TX, 77464		
Accuracy:	0.25KHz		

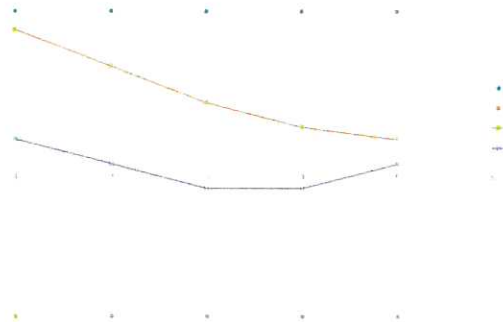
	Result	Max Error	Temperature	Humidity	Atmospheric pressure
As Found	0.00161025	0.0001	46°F	35%	1013.1 hPa
As Laid	0.00161025	0.0001	46°F	35%	1013.1 hPa

Sheet1 - 2024-03-25							Sheet2 - 2024-03-25												
SelfPoints	Reference	Nominal	Reference	Tolerance	Deviation	Error (%)	Test Point	Uml Max	Uml Min	SelfPoints	Reference	Nominal	Reference	Tolerance	Deviation	Error (%)	BFSL	Dev	BFSL Err
psi	psi	V	V	V	V					psi	psi	V	V	V	V				
0	0	0.000	0.011	0.013	0.011	0.22	1	0.25	0.25	0	0	0.000	0.011	0.013	0.011	0.22	0.0100	0.0010	0.040
6000	6000	0.500	0.503	0.013	0.008	0.16	2	0.25	0.25	6000	6000	0.500	0.508	0.013	0.003	0.16	0.5000	0.0000	0.000
12000	12000	1.000	1.005	0.013	0.005	0.10	3	0.25	0.25	12000	12000	1.000	1.005	0.013	0.005	0.10	1.0000	0.0010	0.040
18000	18000	1.500	1.503	0.013	0.003	0.06	4	0.25	0.25	18000	18000	1.500	1.503	0.013	0.003	0.06	1.5000	0.0010	0.040
24000	24000	2.000	2.002	0.013	0.002	0.04	5	0.25	0.25	24000	24000	2.000	2.002	0.013	0.002	0.04	2.0000	0.0000	0.000
30000	30000	2.500	2.501	0.013	0.001	0.02	6	0.25	0.25	30000	30000	2.500	2.501	0.013	0.001	0.02	2.5000	0.0010	0.040
36000	36000	3.000	3.002	0.013	0.002	0.04	7	0.25	0.25	36000	36000	3.000	3.002	0.013	0.002	0.04			
42000	42000	3.500	3.504	0.013	0.004	0.08	8	0.25	0.25	42000	42000	3.500	3.504	0.013	0.004	0.08			
48000	48000	4.000	4.008	0.013	0.008	0.16	9	0.25	0.25	48000	48000	4.000	4.008	0.013	0.008	0.16			
54000	54000	4.500	4.510	0.013	0.010	0.20	10	0.25	0.25	54000	54000	4.500	4.510	0.013	0.010	0.20			
60000	60000	5.000	5.012	0.013	0.012	0.24	11	0.25	0.25	60000	60000	5.000	5.012	0.013	0.012	0.24			
36000	36000	3.000	3.012	0.013	0.012	0.24	12	0.25	0.25	36000	36000	3.000	3.012	0.013	0.012	0.24			
30000	30000	2.500	2.512	0.013	0.012	0.24	13	0.25	0.25	30000	30000	2.500	2.512	0.013	0.012	0.24			
24000	24000	2.000	2.011	0.013	0.011	0.22	14	0.25	0.25	24000	24000	2.000	2.011	0.013	0.011	0.22			
0	0	0.000	0.010	0.013	0.010	0.20	15	0.25	0.25	0	0	0.000	0.010	0.013	0.010	0.20			

Manufacturer	Model	Serial Number	Certificate No.	Due Date	Accuracy	BFSI Error: 0.10%
Apple Corporation	AD268140-GF20-PS-AU	21-H-4920017	923097745	9/26/2024	0.154%	
Apple Corporation	AD12224	317A-813-0470	923097736	9/26/2024	0.015%	
FAEVOU	800214270	5-110	9016233	9/17/2024	1%	

Unit Output	
0 011	
1 005	
2 002	
3 002	
4 008	
5 012	

Terminal	BFS
0.1920	0.1068



We certify the equipment used for this calibration has a test uncertainty ratio of 4:1 or more times greater accuracy than the unit calibrated. All inspections are traceable to the National Institute of Standards and Technology. The Calibration & Certification has been performed to Specialty's Quality & Laboratory Procedures. All Calibration Equipment used per ANSI/NCSL Z540-1:1994.



Specialloy, Inc.
11702 Brittmoore Park Drive
Houston, Texas 77041
(713) 827-7776

Certificate of Calibration

Certificate No.		Transmitter		RESULT: PASS	Print Date
Unit Under Test (UUT)		MTS003076 10 CHANNEL			11/19/2024
UUT ID:	41524	Calibration Date:	11/19/2024		
Model:	GT5295-000003-00	Expiration Date:	11/19/2025		
Range:	0-60000 psi	Manufacturer:	Shallor Technologies		
Resolution:	0.001	Customer:	Mechanical Testing Services		
Application Site:	25520 SQUARES PLUS/41524-117041				
Accuracy:	0.15 % FS				

Calibration Results

	Result	Max Error	Temperature	Humidity	Atmospheric pressure
As Found	in tolerance	0.14 %	88°F	35%	1.0154 Pa
As Left	in tolerance	0.14 %	88°F	35%	1.0154 Pa

Calibration Data - As Found

Max Error: 0.14																	Min Error: 0.02																			
SelfPoints	Reference	Nominal	Reference	Tolerance	Deviation	Error	Test Point	Limit	Limit	SelfPoints	Reference	Nominal	Reference	Tolerance	Deviation	Error	Test Point	Limit	Limit	SelfPoints	Reference	Nominal	Reference	Tolerance	Deviation	Error	Test Point	Limit	Limit	SelfPoints	Reference	Nominal	Reference	Tolerance	Dev	BFSL Err
psi	psi	V	V	V	V	(%)		Max	Min	psi	psi	V	V	V	V	(%)		Max	Min	psi	psi	V	V	V	V	(%)		Max	Min	psi	psi	V	V	(%)		
0	0	0.000	0.003	0.013	0.003	0.06	1	0.25	0.25	0	0	0.000	0.000	0.013	0.003	0.06	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	
6000	6000	0.500	0.500	0.013	0.000	0.00	2	0.25	0.25	6000	6000	0.500	0.500	0.013	0.000	0.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
12000	12000	1.000	0.997	0.013	0.003	0.06	3	0.25	0.25	12000	12000	1.000	0.997	0.013	0.003	0.06	0.9979	0.9979	0.9979	0.9979	0.9979	0.9979	0.9979	0.9979	0.9979	0.9979	0.9979	0.9979	0.9979	0.9979	0.9979	0.9979	0.9979	0.9979		
18000	18000	1.500	1.495	0.013	0.005	0.30	4	0.25	0.25	18000	18000	1.500	1.495	0.013	0.005	0.30	1.4953	1.4953	1.4953	1.4953	1.4953	1.4953	1.4953	1.4953	1.4953	1.4953	1.4953	1.4953	1.4953	1.4953	1.4953	1.4953	1.4953	1.4953		
24000	24000	2.000	1.991	0.013	0.007	0.34	5	0.25	0.25	24000	24000	2.000	1.991	0.013	0.007	0.34	1.9917	1.9917	1.9917	1.9917	1.9917	1.9917	1.9917	1.9917	1.9917	1.9917	1.9917	1.9917	1.9917	1.9917	1.9917	1.9917	1.9917	1.9917	1.9917	
30000	30000	2.500	2.491	0.013	0.007	0.34	6	0.25	0.25	30000	30000	2.500	2.491	0.013	0.007	0.34	2.4916	2.4916	2.4916	2.4916	2.4916	2.4916	2.4916	2.4916	2.4916	2.4916	2.4916	2.4916	2.4916	2.4916	2.4916	2.4916	2.4916	2.4916	2.4916	
36000	36000	3.000	2.991	0.013	0.007	0.34	7	0.25	0.25	36000	36000	3.000	2.991	0.013	0.007	0.34																				
42000	42000	3.500	3.495	0.013	0.005	0.10	8	0.25	0.25	42000	42000	3.500	3.495	0.013	0.005	0.10																				
48000	48000	4.000	3.998	0.013	0.002	0.04	9	0.25	0.25	48000	48000	4.000	3.998	0.013	0.002	0.04																				
54000	54000	4.500	4.501	0.013	0.001	0.02	10	0.25	0.25	54000	54000	4.500	4.501	0.013	0.001	0.02																				
60000	60000	5.000	5.008	0.013	0.006	0.12	11	0.25	0.25	60000	60000	5.000	5.008	0.013	0.006	0.12																				
36000	36000	3.000	3.005	0.013	0.005	0.10	12	0.25	0.25	36000	36000	3.000	3.005	0.013	0.005	0.10																				
30000	30000	2.500	2.505	0.013	0.005	0.10	13	0.25	0.25	30000	30000	2.500	2.505	0.013	0.005	0.10																				
24000	24000	2.000	2.005	0.013	0.005	0.10	14	0.25	0.25	24000	24000	2.000	2.005	0.013	0.005	0.10																				
0	0	0.000	0.001	0.013	0.001	0.07	15	0.25	0.25	0	0	0.000	0.001	0.013	0.001	0.07																				

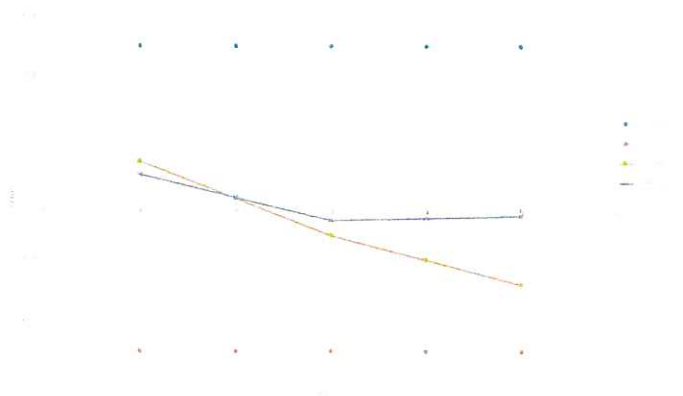
www.AsFound Calibration Data Error

www.AsLeft Calibration Data Error

References

Manufacturer	Model	Serial Number	Certificate No.	Due Date	Accuracy	BFSL ERROR: 0.1275
AdiStar Corporation	AD1681 10-Grade PS-A4	21101-990017	N20092745	9/26/2024	0.15%	
AdiStar Corporation	AD1274	917418013025	N21092700	9/26/2024	0.01%	
HALVIEW	600271270	5-110	9025-33	9/11/2024	1%	

Unit Output
0.003
0.997
1.993
2.993
3.995
5.005
Terminal BFSL
0.2356 0.1275



[Signature]

Specialloy
We certify the equipment used for this calibration has a test uncertainty ratio of 4:1 or maintains greater accuracy than the unit calibrated.
All inspections are traceable to the National Institute of Standards and Technology. The Calibration & Certification
have been performed to Specialloy's Quality & Laboratory Procedures. All Calibration Equipment used per ANSI/NIST Z39.1-1994.



Transmitter

Certificate No. MTS003076 10 CHANNEL RESULT: PASS Print Date 11/19/2014

Unit ID :	14-9786
Model:	GTS002-6000G2-RP
Range:	(0 ~ 9999)gms
Resolution:	0.001g
Application Site:	265201010KES PQWALF-FE-77Agd
Accuracy:	± 0.001%

Calibration Results

	Result	Max Error	Temperature	Humidity	Atmospheric pressure
A ₁ Found	9.16mPa	-0.22 %	68°F	35%	1.01325 × 10 ⁵ Pa
A ₁ Left	9.16mPa	-0.22 %	68°F	35%	1.01325 × 10 ⁵ Pa

Calibration Data - As Left

SelfPoints Reference							SelfPoints Reference									
psi	psi	V	V	Tolerance	Deviation	Error (%)	Test Point	Limit Max	Limit Min	psi	psi	V	V	Tolerance	Deviation	Error (%)
0	0	0.000	0.000	0.013	0.002	0.04	1	0.25	0.25	0	0	0.000	0.002	0.013	0.002	0.04
6000	6000	0.500	0.499	0.013	0.001	0.02	2	0.25	0.25	6000	6000	0.500	0.499	0.013	0.001	0.02
12000	12000	1.000	0.995	0.013	0.005	0.10	3	0.25	0.25	12000	12000	1.000	0.995	0.013	0.005	0.10
18000	18000	1.500	1.492	0.013	0.008	0.16	4	0.25	0.25	18000	18000	1.500	1.492	0.013	0.008	0.16
24000	24000	2.000	1.990	0.013	0.010	0.20	5	0.25	0.25	24000	24000	2.000	1.990	0.013	0.010	0.20
30000	30000	2.500	2.489	0.013	0.011	0.22	6	0.25	0.25	30000	30000	2.500	2.489	0.013	0.011	0.22
36000	36000	3.000	2.990	0.013	0.010	0.20	7	0.25	0.25	36000	36000	3.000	2.990	0.013	0.010	0.20
42000	42000	3.500	3.492	0.013	0.008	0.16	8	0.25	0.25	42000	42000	3.500	3.492	0.013	0.008	0.16
48000	48000	4.000	3.995	0.013	0.005	0.10	9	0.25	0.25	48000	48000	4.000	3.995	0.013	0.005	0.10
54000	54000	4.500	4.500	0.013	0.000	0.00	10	0.25	0.25	54000	54000	4.500	4.500	0.013	0.000	0.00
60000	60000	5.000	5.011	0.013	0.003	0.06	11	0.25	0.25	60000	60000	5.000	5.011	0.013	0.003	0.06
66000	66000	5.500	5.008	0.013	0.008	0.16	12	0.25	0.25	66000	66000	5.500	5.008	0.013	0.008	0.16
72000	72000	6.000	5.509	0.013	0.009	0.18	13	0.25	0.25	72000	72000	6.000	5.509	0.013	0.009	0.18
78000	78000	6.500	6.009	0.013	0.009	0.18	14	0.25	0.25	78000	78000	6.500	6.009	0.013	0.009	0.18
0	0	0.000	0.006	0.013	0.006	0.12	15	0.25	0.25	0	0	0.000	0.006	0.013	0.006	0.12

www.AristoControl.com/EndUser

Manufacturer	Model	Serial Number	Certificate No.	Due Date	Accuracy	BFSL ERROR: 0.1362
Adidas Corporation	AD7681-10-OP60H-PS1-AM	313H19900017	1230927945	9/25/2024	0.1365	
Adidas Corporation	AD7122-4	313A19910005	1230927932	9/24/2024	0.0119	
FALEWILL	6012771270	3110	9026733	9/11/2024	0	

Unit Output
0.002
0.995
1.99
2.99
3.995
5.003

Terminal	BFS
0.2519	0.136



We certify the equipment used for this calibration has a test uncertainty ratio of 4:1 or more times greater accuracy than the unit calibrated. All inspections are traceable to the National Institute of Standards and Technology. The Calibration & Certifications have been performed to Specialty's Quality & Laboratory Procedures. All Calibration Equipment used per: AIAG/ISO 91:25, 30, 1, 1994.



Specialty Alloy, Inc.
11702 Brittmoore Park Drive
Houston, Texas 77041
(713) 827-7776

Certificate of Calibration

Transmitter			
Certificate No.	100116-017	MT5003075 1Q CHANNEL	RESULT: PASS
Unit Under Test (UUT)	Print Date 10/1/2024		
UUT ID:	14-5794	Calibration Date:	10/1/2024
Model:	27500-00000-100	Expiration Date:	10/1/2025
Range:	0.00000 to 2.50000	Manufacturer:	Specialty Alloy, Inc.
Resolution:	0.00001	Customer:	Georgian Tech, LLC
Application Site:	22500 STREET RD, WAX, TX 77084		
Accuracy:	0.00005		

Calibration Results

	Result	Max Error	Temperature	Humidity	Atmospheric pressure
As Found	Out of tolerance	0.0015	88°F	15%	30.4 inHg
As Left	In tolerance	0.0015	88°F	21%	30.4 inHg

Calibration Data - As Found

SetPoints	Reference	Nominal	Reference	Tolerance	Deviation	Error
psi	psi	V	V	V	V	(%)
0	0	0.000	0.000	0.011	0.000	0.00
6000	6000	0.500	0.504	0.011	-0.006	0.12
12000	12000	1.000	0.990	0.011	0.010	-0.20
18000	18000	1.500	1.487	0.011	0.013	-0.26
24000	24000	2.000	1.985	0.011	0.015	-0.30
30000	30000	2.500	2.484	0.011	0.016	-0.32
36000	36000	3.000	2.986	0.011	0.014	-0.28
42000	42000	3.500	3.488	0.011	0.012	-0.24
48000	48000	4.000	3.992	0.011	0.008	-0.16
54000	54000	4.500	4.498	0.011	0.002	-0.04
60000	60000	5.000	5.003	0.011	-0.001	-0.06
66000	66000	5.500	5.495	0.011	0.005	-0.10
72000	72000	6.000	5.995	0.011	0.005	-0.10
78000	78000	6.500	6.497	0.011	0.003	-0.14
84000	84000	7.000	6.994	0.011	0.006	-0.08
90000	90000	7.500	7.494	0.011	0.006	-0.08
0	0	0.000	0.000	0.011	0.000	0.00

www.As-Found-Calibration-Data-Print-out

Calibration Data - As Left

SetPoints	Reference	Nominal	Reference	Tolerance	Deviation	Error	BFSL	Dev	BFSL Err
psi	psi	V	V	V	V	(%)			(%)
0	0	0.000	0.002	0.011	0.002	0.04	0.0001	0.0019	0.075
6000	6000	0.500	0.497	0.011	0.003	0.06	0.4971	0.0003	0.011
12000	12000	1.000	0.991	0.011	0.009	0.14	0.9941	0.0014	0.051
18000	18000	1.500	1.490	0.011	0.010	0.20	1.4916	0.0016	0.063
24000	24000	2.000	1.988	0.011	0.012	0.24	1.9887	0.0007	0.029
30000	30000	2.500	2.488	0.011	0.012	0.21	2.4850	0.0021	0.086
36000	36000	3.000	2.989	0.011	0.011	0.22			
42000	42000	3.500	3.492	0.011	0.008	0.16			
48000	48000	4.000	3.996	0.011	0.004	0.08			
54000	54000	4.500	4.500	0.011	0.000	0.00			
60000	60000	5.000	5.005	0.011	0.005	0.10			
66000	66000	5.500	5.507	0.011	0.007	0.14			
72000	72000	6.000	6.000	0.011	0.000	0.00			
78000	78000	6.500	6.500	0.011	0.000	0.00			
84000	84000	7.000	7.000	0.011	0.000	0.00			
90000	90000	7.500	7.500	0.011	0.000	0.00			
0	0	0.000	0.000	0.011	0.000	0.00			

www.As-Left-Calibration-Data-Print-out

References

Manufacturer	Model	Serial Number	Certificate No.	Due Date	Accuracy
Address Corporation	ADT6H-10-03PAC-PSHAK	217H199E0017	102602745	10/26/2024	0.0005
Address Corporation	ADT122A	217A14010510	102602702	9/14/2024	0.0017
FAIRCHILD	1002T42TD	3110	9075133	9/11/2024	0.01

BFSL ERROR: 0.1656

Unit Output	
0.002	
0.990	
1.986	
2.989	
3.995	
5.005	
Terminal	BFSL
0.3036	0.1656

Special Alloy
We certify the equipment used for this calibration has a test uncertainty ratio of 4:1 or more times greater accuracy than the unit calibrated.
All inspections are traceable to the National Institute of Standards and Technology. The Calibration & Certifications
have been performed to Specialty Alloy's Calibration Procedures. All Calibration Equipment used per NIST 410.2, 410.2.1, 410.2.2, 410.2.3, 410.2.4, 410.2.5, 410.2.6, 410.2.7, 410.2.8, 410.2.9, 410.2.10, 410.2.11, 410.2.12, 410.2.13, 410.2.14, 410.2.15, 410.2.16, 410.2.17, 410.2.18, 410.2.19, 410.2.20, 410.2.21, 410.2.22, 410.2.23, 410.2.24, 410.2.25, 410.2.26, 410.2.27, 410.2.28, 410.2.29, 410.2.30, 410.2.31, 410.2.32, 410.2.33, 410.2.34, 410.2.35, 410.2.36, 410.2.37, 410.2.38, 410.2.39, 410.2.40, 410.2.41, 410.2.42, 410.2.43, 410.2.44, 410.2.45, 410.2.46, 410.2.47, 410.2.48, 410.2.49, 410.2.50, 410.2.51, 410.2.52, 410.2.53, 410.2.54, 410.2.55, 410.2.56, 410.2.57, 410.2.58, 410.2.59, 410.2.60, 410.2.61, 410.2.62, 410.2.63, 410.2.64, 410.2.65, 410.2.66, 410.2.67, 410.2.68, 410.2.69, 410.2.70, 410.2.71, 410.2.72, 410.2.73, 410.2.74, 410.2.75, 410.2.76, 410.2.77, 410.2.78, 410.2.79, 410.2.80, 410.2.81, 410.2.82, 410.2.83, 410.2.84, 410.2.85, 410.2.86, 410.2.87, 410.2.88, 410.2.89, 410.2.90, 410.2.91, 410.2.92, 410.2.93, 410.2.94, 410.2.95, 410.2.96, 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Specialloy, Inc.
11702 Brittmoore Park Drive
Houston, Texas 77041
(713) 827-7776

Certificate of Calibration

Certificate No.		Transmitter		RESULT:	Print Date
MTS003076		10 CHANNEL		PASS	01/06/2024
Unit Under Test(UUT)					
UUT ID:	1411241	Calibration Date:	01/06/2024		
Model:	GT5006 (0000000000)	Expiration Date:	01/06/2025		
Range:	0 to 50000psi	Manufacturer:	JTEC Technology		
Resolution:	0.0001psi	Customer:	Koch Engineering, Inc.		
Application Site:	100%20 THERMAL RESISTANCE				
Accuracy:	0.25%FS				

Calibration Results

	Result	Max Error	Temperature	Humidity	Atmospheric pressure
As Found	0.109%FS	0.72%FS	68°F	35%	1015.8 kPa
As Left	0.109%FS	0.72%FS	68°F	35%	1015.8 kPa

Calibration Data - As Found

SetPoints	Reference	Nominal	Reference	Tolerance	Deviation	Error
psi	psi	V	V	V	V	(%)
0	0	0.000	0.000	0.013	0.000	0.00
6000	6000	0.500	0.501	0.013	0.001	0.02
12000	12000	1.000	1.000	0.013	0.000	0.00
18000	18000	1.500	1.501	0.013	0.001	0.02
24000	24000	2.000	2.002	0.013	0.002	0.04
30000	30000	2.500	2.505	0.013	0.005	0.10
36000	36000	3.000	3.009	0.013	0.009	0.18
42000	42000	3.500	3.514	0.013	0.014	0.78
48000	48000	4.000	4.021	0.013	0.021	0.42
54000	54000	4.500	4.528	0.013	0.028	0.56
60000	60000	5.000	5.016	0.013	0.016	0.72
36000	36000	3.000	3.018	0.013	0.018	0.46
30000	30000	2.500	2.512	0.013	0.012	0.24
24000	24000	2.000	2.006	0.013	0.006	0.12
0	0	0.000	0.001	0.013	0.001	0.06

*** As Found Calibration Data Ends ***

Calibration Data - As Left

Test Point	UUT Max	UUT Min	SetPoints	Reference	Nominal	Reference	Tolerance	Deviation	Error	BFSL	Dev	BFSL Err
			psi	psi	V	V	V	V	(%)			(%)
1	0.25	0.25	0	0	0.000	0.000	0.013	0.000	0.00	0.0000	0.0006	0.021
2	0.25	0.25	6000	6000	0.500	0.501	0.013	0.001	0.02	0.5000	0.0007	0.030
3	0.25	0.25	12000	12000	1.000	1.000	0.013	0.000	0.00	1.0001	0.0011	0.041
4	0.25	0.25	18000	18000	1.500	1.501	0.013	0.001	0.02	1.5010	0.0009	0.036
5	0.25	0.25	24000	24000	2.000	2.002	0.013	0.002	0.04	2.0027	0.0007	0.030
6	0.25	0.25	30000	30000	2.500	2.505	0.013	0.005	0.10	2.5036	0.0014	0.057
7	0.25	0.25	36000	36000	3.000	3.009	0.013	0.009	0.18			
8	0.25	0.25	42000	42000	3.500	3.514	0.013	0.014	0.78			
9	0.25	0.25	48000	48000	4.000	4.021	0.013	0.021	0.42			
10	0.25	0.25	54000	54000	4.500	4.528	0.013	0.028	0.56			
11	0.25	0.25	60000	60000	5.000	5.016	0.013	0.016	0.72			
12	0.25	0.25	36000	36000	3.000	3.018	0.013	0.018	0.46			
13	0.25	0.25	30000	30000	2.500	2.512	0.013	0.012	0.24			
14	0.25	0.25	24000	24000	2.000	2.006	0.013	0.006	0.12			
15	0.25	0.25	0	0	0.000	0.001	0.013	0.001	0.06			

*** As Left Calibration Data Ends ***

References

Manufacturer	Model	Serial Number	Certificate No.	Due Date	Accuracy	BFSL ERROR: 0.1352
Adair Corporation	ADT64110-GR604-PS-AM	211017950017	1015092745	01/06/2024	0.15%FS	
Adair Corporation	ADT2024	817413010007	1015092746	01/06/2024	0.15%	
FA, Inc.	600271127D	0110	1015092747	01/06/2024	0.15%	

Unit Output	
0	
1	
2.002	
3.009	
4.021	
5.036	
Terminal	BFSL
0.2502	0.1352

CUSTOMER ACCEPTS MAX TOLERANCE OF 0.72%FS

Specialloy, Inc. is a NIST accredited calibration laboratory. All equipment used for this calibration has a test uncertainty ratio of 4:1 or more (higher is better accuracy than the unit being tested). All inspections are performed to the National Institute of Standards and Technology. The Calibration & Certification have been performed to Specialloy's Quality & Laboratory Procedures. All Calibration Equipment used per ANSI Z39.51-1994.



Specialty, Inc.
11702 Brittmoore Park Drive
Houston, Texas 77041
(713) 827-7776

Certificate of Calibration

Transmitter

Certificate No. 103162435 MTS003076 10 CHANNEL RESULT: PASS Print Date 10/18/2024

Unit Under Test(UUT)

UUT ID : 14132435
Model: MT5000-4000-0.10%
Range: 0-60000 psi
Resolution: 0.001V
Application Site: 103162435 Receiver, L1, 75494
Accuracy: 0.10%FS

Calibration Date: 10/18/2024
Expiration Date: 10/18/2025
Manufacturer: Special Technology
Customer: Special Technology, Inc.

Calibration Results

	Result	Max Error	Temperature	Humidity	Atmospheric pressure
As Found	within tolerance	0.50%FS	65°F	95%	1013.47 hPa
As Left	within tolerance	0.50%FS	66°F	95%	1013.47 hPa

Calibration Data - As Found

SetPoints	Reference	Nominal	Reference	Tolerance	Deviation	Error
psi	psi	V	V	V	V	(%)
0	0	0.000	0.010	0.013	0.010	0.20
6000	6000	0.500	0.507	0.013	0.007	0.11
12000	12000	1.000	1.009	0.013	0.009	0.10
18000	18000	1.500	1.504	0.013	0.004	0.08
24000	24000	2.000	2.004	0.013	0.004	0.08
30000	30000	2.500	2.504	0.013	0.004	0.08
36000	36000	3.000	3.007	0.013	0.007	0.14
42000	42000	3.500	3.509	0.013	0.009	0.18
48000	48000	4.000	4.014	0.013	0.014	0.28
54000	54000	4.500	4.519	0.013	0.019	0.38
60000	60000	5.000	5.025	0.013	0.025	0.50
12000	12000	1.000	1.023	0.013	0.023	0.46
18000	18000	1.500	1.521	0.013	0.021	0.42
24000	24000	2.000	2.019	0.013	0.019	0.38
0	0	0.000	0.011	0.013	0.011	0.22

www.AsFound Calibration Data End here

Calibration Data - As Left

SetPoints	Reference	Nominal	Reference	Tolerance	Deviation	Error	BFSL	Dev	BFSL Err
psi	psi	V	V	V	V	(%)			(%)
0	0	0.000	0.010	0.013	0.010	0.20	0.0085	0.0015	0.059
6000	6000	0.500	0.507	0.013	0.007	0.14	0.5074	0.0034	0.015
12000	12000	1.000	1.009	0.013	0.009	0.10	1.0062	0.0012	0.050
18000	18000	1.500	1.504	0.013	0.004	0.08	1.5051	-0.0011	-0.044
24000	24000	2.000	2.004	0.013	0.004	0.08	2.0030	0.0030	0.002
30000	30000	2.500	2.504	0.013	0.004	0.08	2.5028	0.0012	0.048
36000	36000	3.000	3.007	0.013	0.007	0.14			
42000	42000	3.500	3.509	0.013	0.009	0.18			
48000	48000	4.000	4.014	0.013	0.014	0.28			
54000	54000	4.500	4.519	0.013	0.019	0.38			
60000	60000	5.000	5.025	0.013	0.025	0.50			
12000	12000	1.000	1.023	0.013	0.023	0.46			
18000	18000	1.500	1.521	0.013	0.021	0.42			
24000	24000	2.000	2.019	0.013	0.019	0.38			
0	0	0.000	0.011	0.013	0.011	0.22			

www.AsLeft Calibration Data End here

References

Manufacturer	Model	Serial Number	Certificate No.	Due Date	Accuracy	BFSL ERROR: 0.017
Adriel Corporation	AD7661-10-00V/0.05-AM	211119900017	103092745	9/24/2024	0.15%FS	
Adriel Corporation	AD7661-10	211119900004	103092700	9/24/2024	0.01%	
FALEVAL	AD02111702	0310	9029233	9-1-2024	1%	

Unit Output	
0.01	
1.005	
2.004	
3.007	
4.021	
5.025	
Terminal	BFSL
0.2353	0.1396

Inspector
We certify the equipment used for this calibration has a test uncertainty ratio of 4:1 or more times greater accuracy than the unit calibrated.
All inspections are traceable to the National Institute of Standards and Technology. The Calibration & Certifications
have been performed to Specialty's Quality System Procedures. All Calibration Equipment used per MSA/ISO 17025:2017

CUSTOMER ACCEPTS MAX TOLERANCE OF 0.50%FS

Appendix D Final Test Report - Locking Bridge Plug



Safety, Environmental, and Performance Test Report



7" Locking Bridge Plug

Test 16

MTS Project Number
7002-22-2010

August 2023

Test Report for
7" Locking Bridge Plug
Test 16
August 2023

Revision 0

PetroQuip Energy Services

Authorized By: Robert Coon

Project Lead:



Jason Lucas, Lab Technician

Project Manager:



Scott Wilson, Vice President



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1	Executive Summary
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Executive Summary

Mechanical Testing Services tested the 7" Locking Bridge Plug to the test procedure provided by PetroQuip Energy Services. MTS and PetroQuip worked together to develop this detailed test procedure. In addition, MTS and PetroQuip reviewed all safety concerns and needs for special fixtures and equipment for performing the test. Before work started, both teams had a safety meeting and operations review to ensure all precautions were taken.

PetroQuip assembled the test specimen and MTS installed the test specimen into the fixture. MTS installed thermocouples, heat insulation, cooling apparatus, heating induction, filled test article with oil, and attached the hydraulic cylinder. The specimen was then loaded into the test bunker.

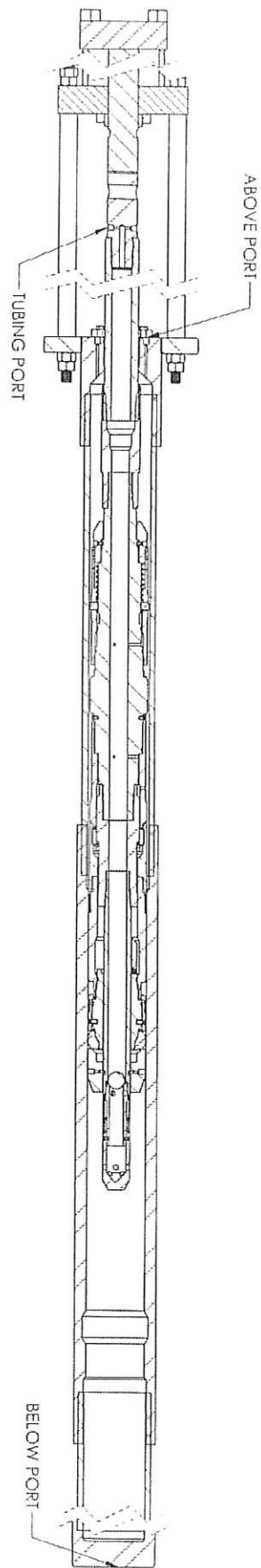
The full test procedure was performed successfully. The specimen was removed from the test bunker and disassembled. PetroQuip will decide what additional testing may be required to further validate the Locking Bridge Plug for field use.

2	Test Procedure
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8/4/23

Locking Bridge Plug Elevated Temperature Operation Test

1. Perform hazard assessment and hold operational safety meeting.
2. Assemble the full test fixture as per PetroQuip drawing #PQA341.
3. Fill the entire test fixture with oil minimizing trapped air.
4. Pressure all 3 chambers, 10,000 psi (+500/-0 psi). Hold for 15 minutes without pressure loss greater than 1% over 15 minutes.
5. Bleed to zero on all 3 lines.
6. Disconnect lines to separate annular and tubing communication.
7. Trap and maintain 500 psi on all 3 chambers. Heat up assembly to 450°F (+30/-0°F) at 50°F per hour until temperature is stable and soaked (min 4 hours).
8. Run the locking bridge plug and running tool assembly completely through the landing profile. Ensure the entire assembly passes through the nipple.
9. Pull back the locking bridge plug and running tool assembly completely through the landing profile. Ensure the entire assembly passes through the nipple.
10. Apply 1,000 psi (+50/-0 psi) to the internal volume of the running tool to expand locator dogs.
11. While holding pressure, stroke in until the locking bridge plug and running tool assembly stops.
12. Apply 15,000 (+1000/-1000 psi) pounds force using the hydraulic cylinder.
13. Increase internal volume pressure to 3,500 psi (+175/-0 psi) to set the locking bridge plug.
14. Hold internal volume pressure for 5 minutes.
15. Reduce internal volume pressure to zero. ~~KEEP 500 DIFF ON TBG~~
16. Stop data collection, start new file at 10 HZ.
17. Stoke the hydraulic cylinder back to release the running tool from the locking bridge plug. Continue to stroke the hydraulic cylinder to its maximum stroked in position. Record max cylinder pressure readings required to shear the pin in the Bridge Plug. Convert to lb force based on load chart.
 BLEED TO 500
18. Stop data collection, start new file at 1 HZ.
19. Apply 7,500 psi (+300/-0 psi) external pressure to the port above locking bridge plug.
 — P TBG TO TB
20. Hold external pressure for 90 minutes without pressure loss greater than 1% over 15 minutes.
 BLOW BALL SEAT
21. Reduce assembly to 350°F (+30/-0°F) until temperature is stable while holding the 7,500 psi external pressure.
22. Hold external pressure for 90 minutes without pressure loss greater than 1% over 15 minutes.
23. Reduce pressure to zero.
24. Reduce temperature to ambient.
25. Remove the running tool from the hydraulic ram.
26. Attach PetroQuip supplied retrieving tool.
27. Retrieve locking bridge plug from landing profile while recording max cylinder pressure required to release. Convert cylinder pressure to lb force based on attached load chart.
28. Send all test articles to inspection and prepare for next test.



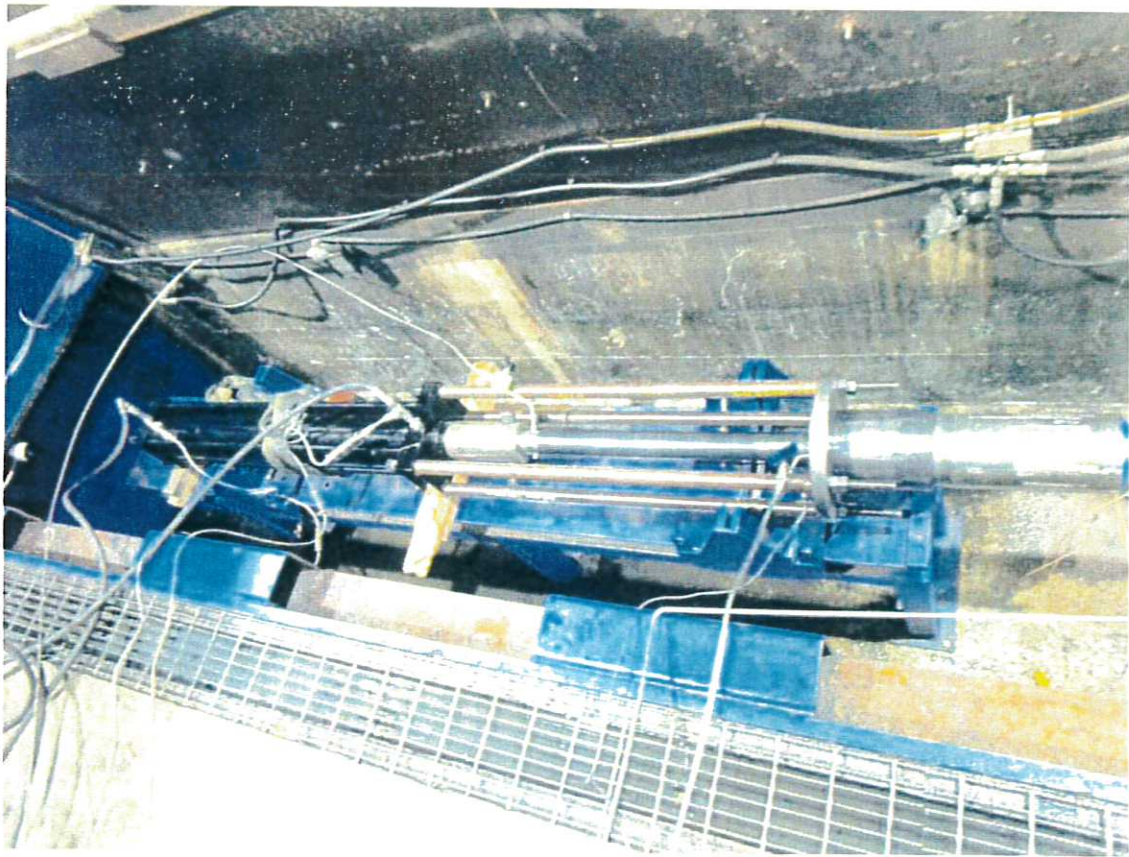
Hydraulic Cylinder Pressure - Load Chart

Model No.: HH-ME5-700x48-300-KK4-P15=N750-SS55

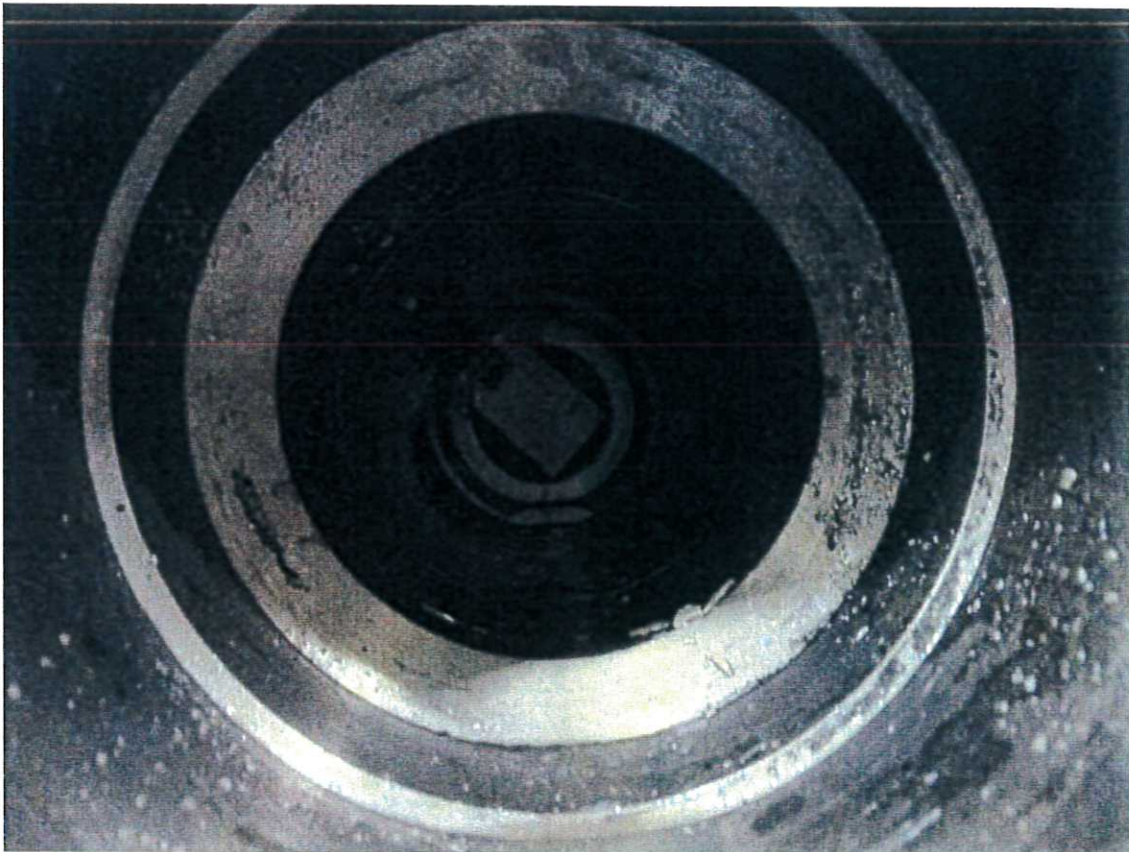
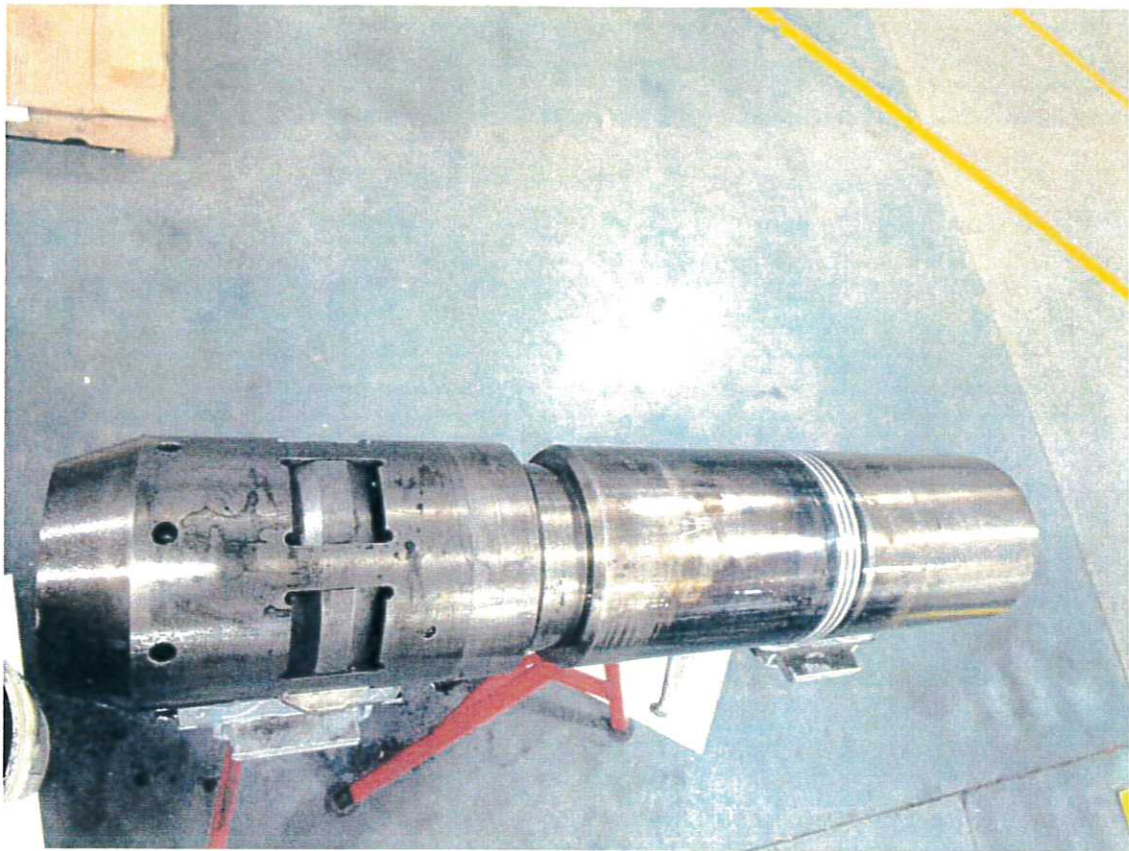
Pressure	Extend Load	Retract Load
100	3848	3142
200	7697	6283
300	11545	9425
400	15394	12566
500	19242	15708
600	23091	18850
700	26939	21991
800	30788	25133
900	34636	28274
1000	38485	31416
1100	42333	34558
1200	46181	37699
1300	50030	40841
1400	53878	43982
1500	57727	47124
1600	61575	50265
1700	65424	53407
1800	69272	56549
1900	73121	59690
2000	76969	62832
2100	80817	65973
2200	84666	69115
2300	88514	72257
2400	92363	75398
2500	96211	78540
2600	100060	81681
2700	103908	84823
2800	107757	87965
2900	111605	91106
3000	115454	94248

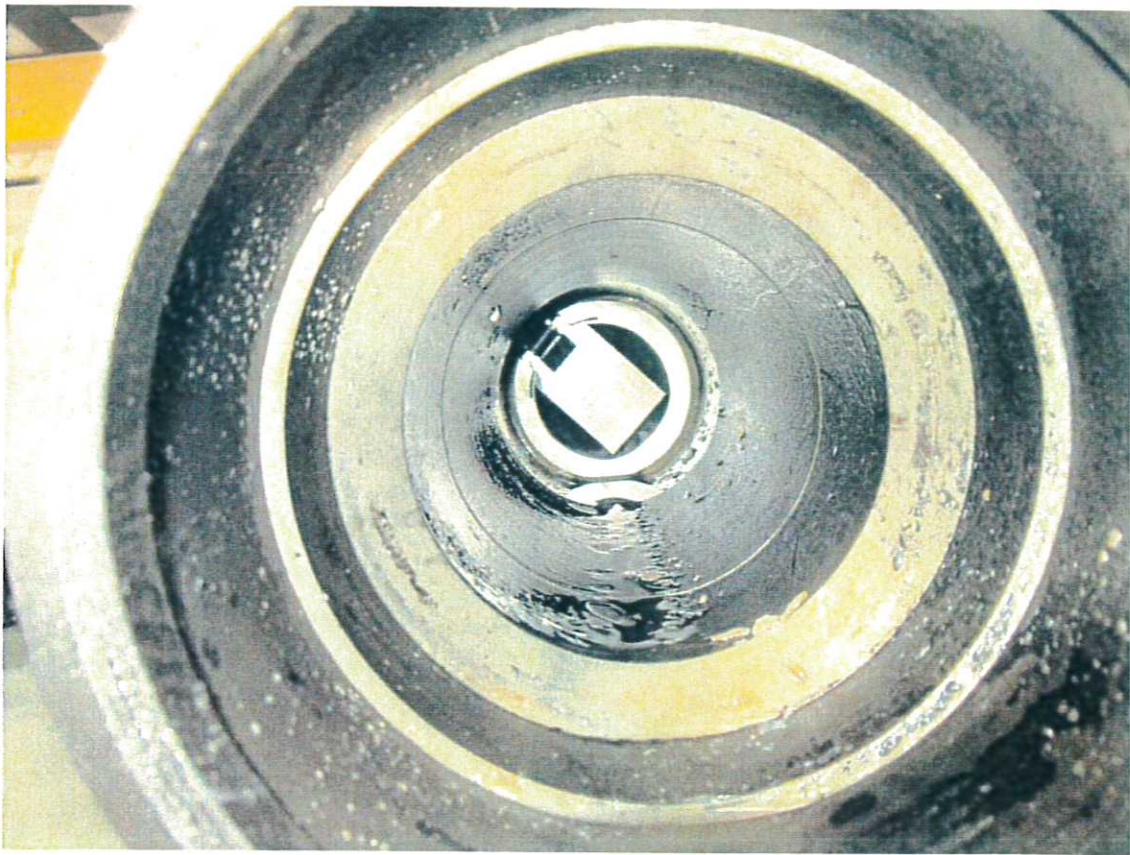
3	Test Setup Pictures
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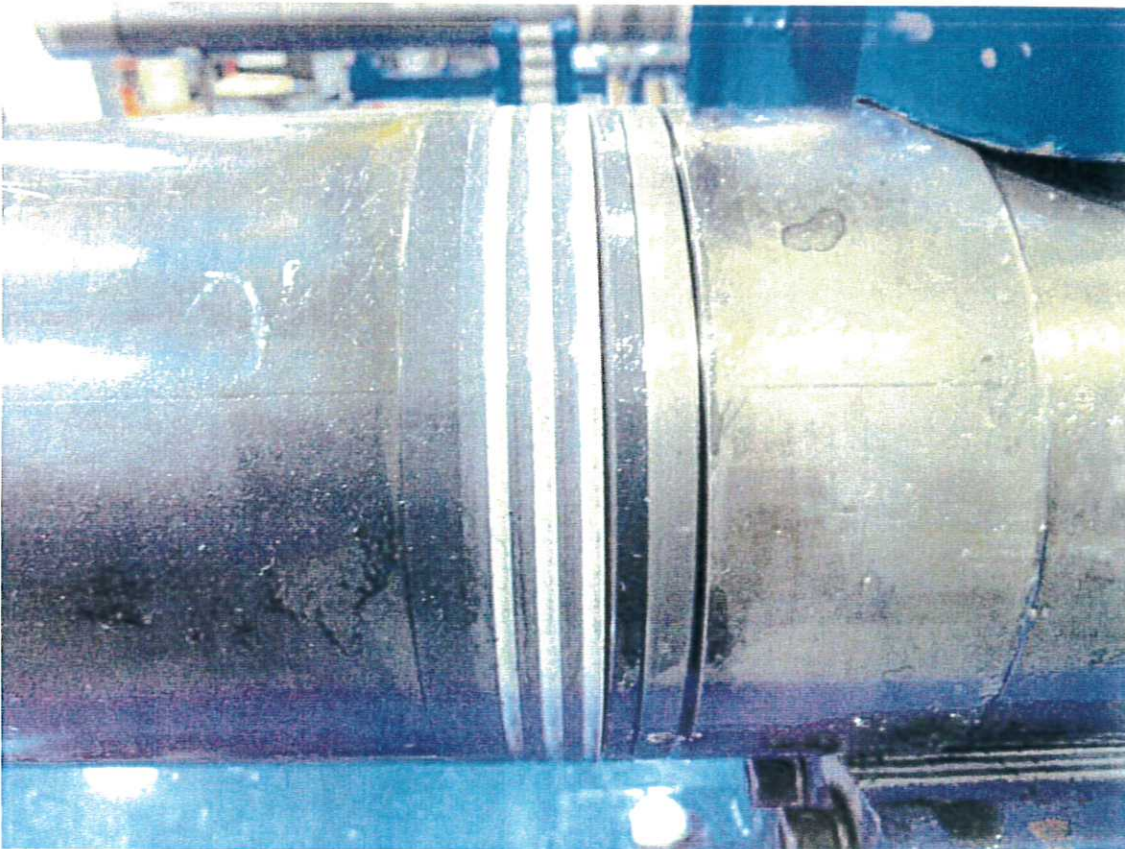
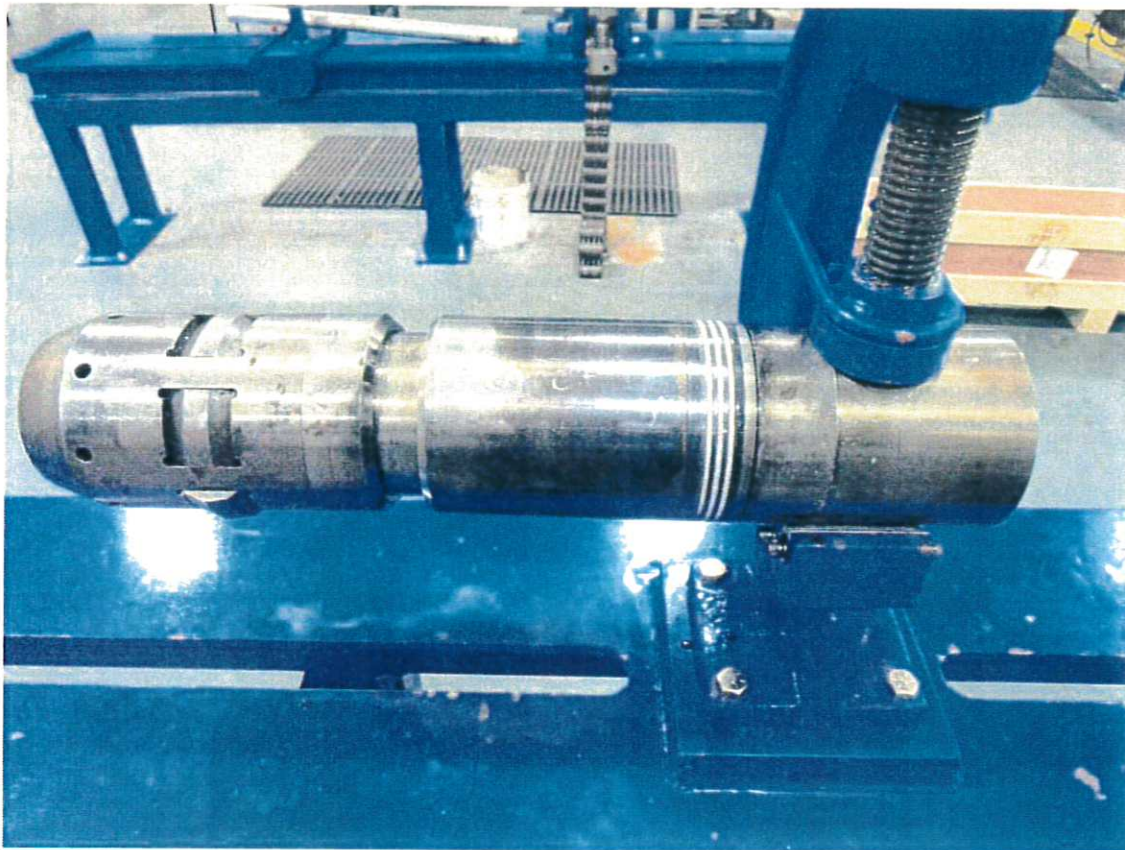


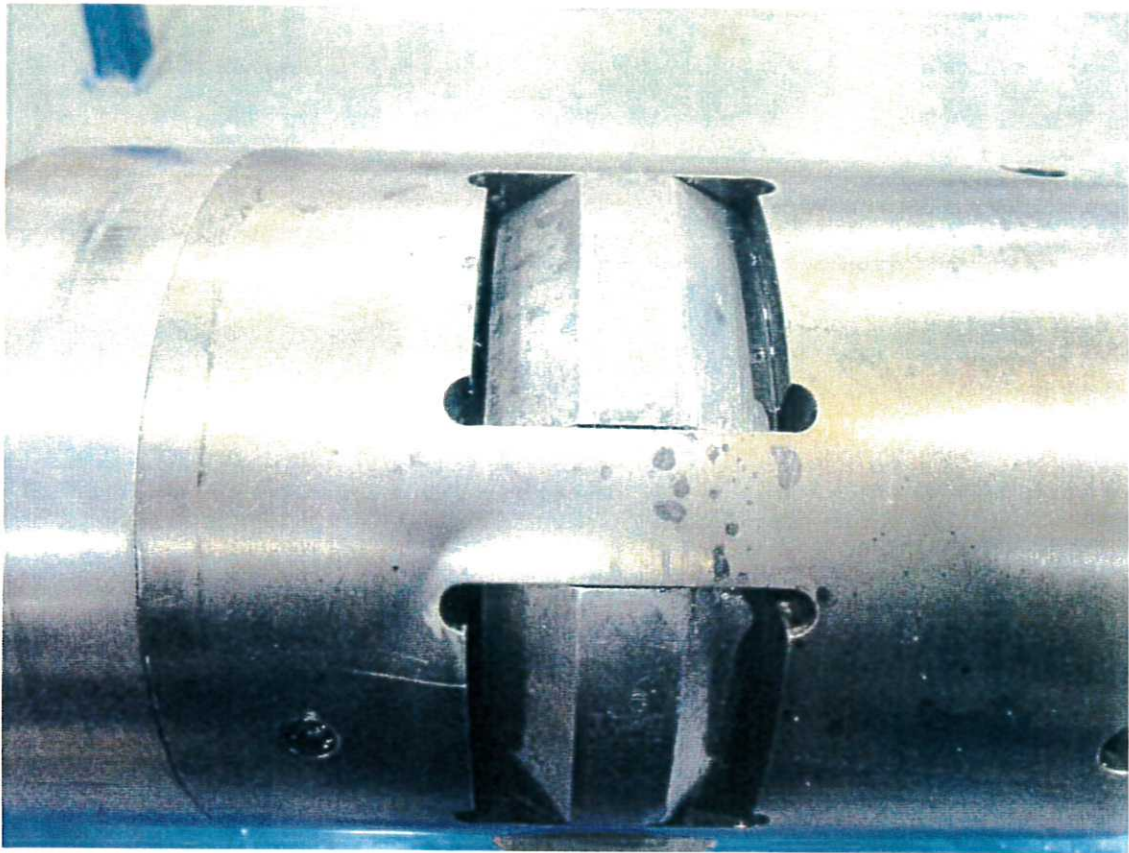












4	Technician Hand Logs
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Customer: _____ PetroQuip _____ Project No.: 7002-22-2010

Project/ Material Description: Locking Bridge Plug Elevated Temperature Operation Test

Time	Load Step	Extend RAM		Retract	Tubing	Below	Above	Temperature		LVDT	Leak Detection
		UP	DOWN					0	180		
8:27	4				0	0	0	74.74	74.3	.007	N/A
Test Notes: Pressure ↑											
10:09	4				10/50	10338	10328	75	75	.197	N/A
Test Notes: Start 15 min Hold											
10:24	4				10/17	10285	10272	77.2	77.3	.147	N/A
Test Notes: Complete 15 min Hold											
10:30	5				29	47	44	76.7	76.6	.099	N/A
Test Notes: Bleed to Zero Stop Duct											
7:47	7										
Test Notes: 8/7/23 Heat up											
7:47	7				565	587	587	73.3	73.6	.097	N/A
Test Notes: Pressure ↑ 500 psi Start Heat ↑ to 450 (+30f0)											
8/8/23 Heat up Complete @ 15:09											
8/1											
N/A											
Per Client skip step 8-9											
8:19	10				550	586	586	468.1	450.9	.098	N/A
Test Notes: Apply 1000 psi dif. to tubing											
8:25	10				1640	598	598	467.7	450.6	.098	N/A
Test Notes: 1500 force											
8:44	12				1685	373	372	467.9	456.6	-26.875	N/A
Test Notes: 16400											

Completed By: Travis Nassar Date: 8/4/23 / 8/7/23

Customer/TPI: _____ Date: _____

Customer: PetroQuip Project No.: 7002-22-2010

Project/ Material Description: Locking Bridge Plug Elevated Temperature Operation Test

Time	Load Step	RAM		Tubing	Below	Above	Temperature		LVDT	Leak Detection
		UP	DOWN				0	180		
8:52	13	15468		4178	555	555	466.3	457.2	-26.870	N/A
Test Notes: Pressure 3500 psi Diaphragm										
8:59	14	17620		4272	498	499	465.8	457.5	-25.869	N/A
Test Notes: 5 min Hold										
9:06	15	15023		998	430	430	465.4	457.8	-26.868	N/A
Test Notes: Reduce pressure 500 Diff on Tubing per Client.										
9:11	17	+29493	-29855	605	56	57	467.5	454.6	-0.095	N/A
Test Notes: Shear Event step 17										
9:33	added step	-520		2746	611	600	467.2	442.5	.097	N/A
Test Notes: added step per Client to blow ball seat										
9:50	19			8139	549	8086	467.8	449.0	.156	N/A
Test Notes: Apply 7500 to Above										
9:58	20			8388	602	8288	467.9	451.4	.161	N/A
Test Notes: Start Hold										
11:30	20			8377	622	8382	466.9	456.4	.160	N/A
Test Notes: End Hold										
13:48	22			8383	3730	8396	376.0	373.0	.162	N/A
Test Notes: Drop Temp Start Hold 90 min										
15:18	22			7753	71	7766	376.3	372.5	.161	N/A
Test Notes: End Hold										
15:21	23/24									
Test Notes: Reduce Pressure to zero & Drop temp to ambient.										

Completed By

Date 8/8/23

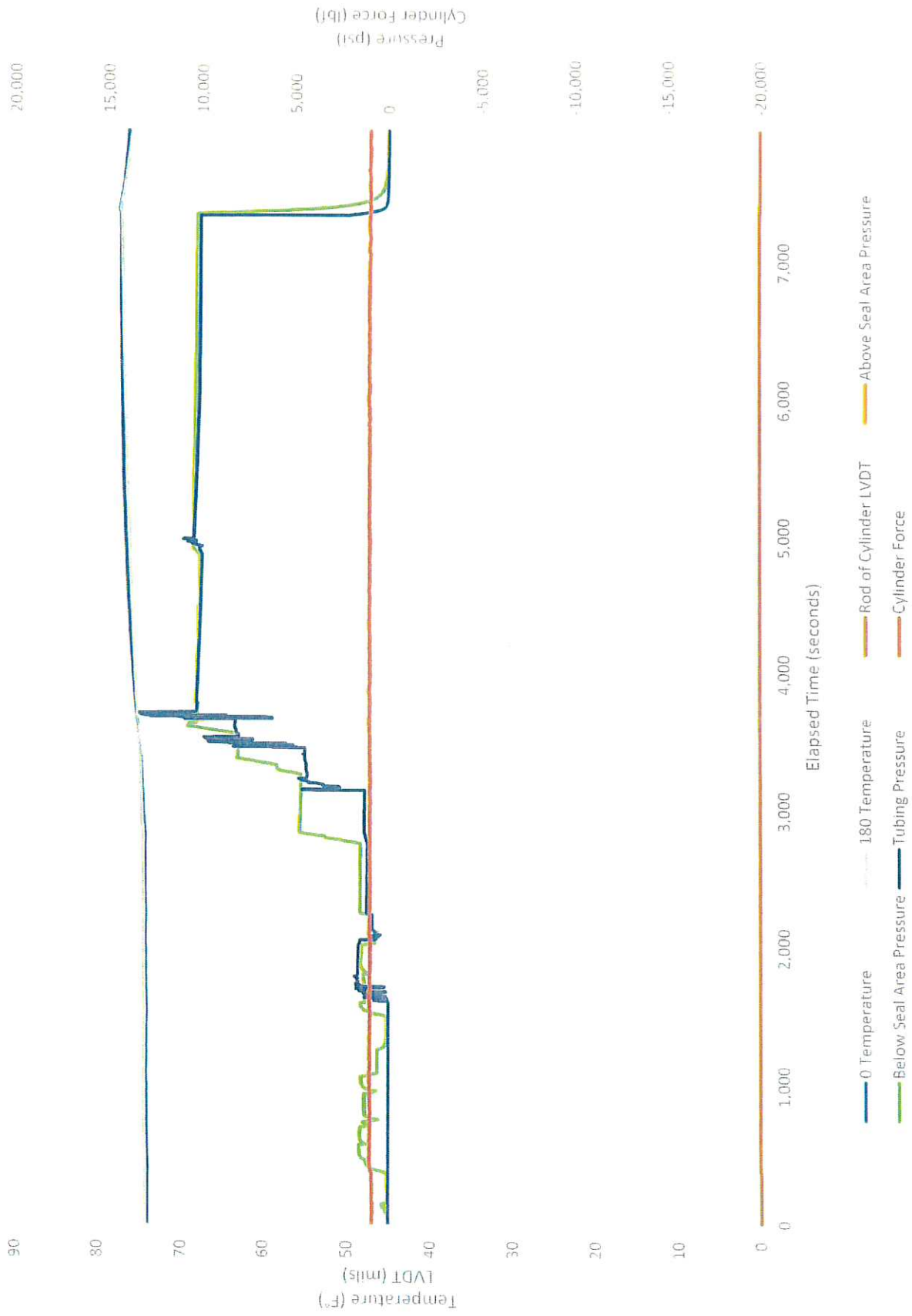
Customer/TPI

Date

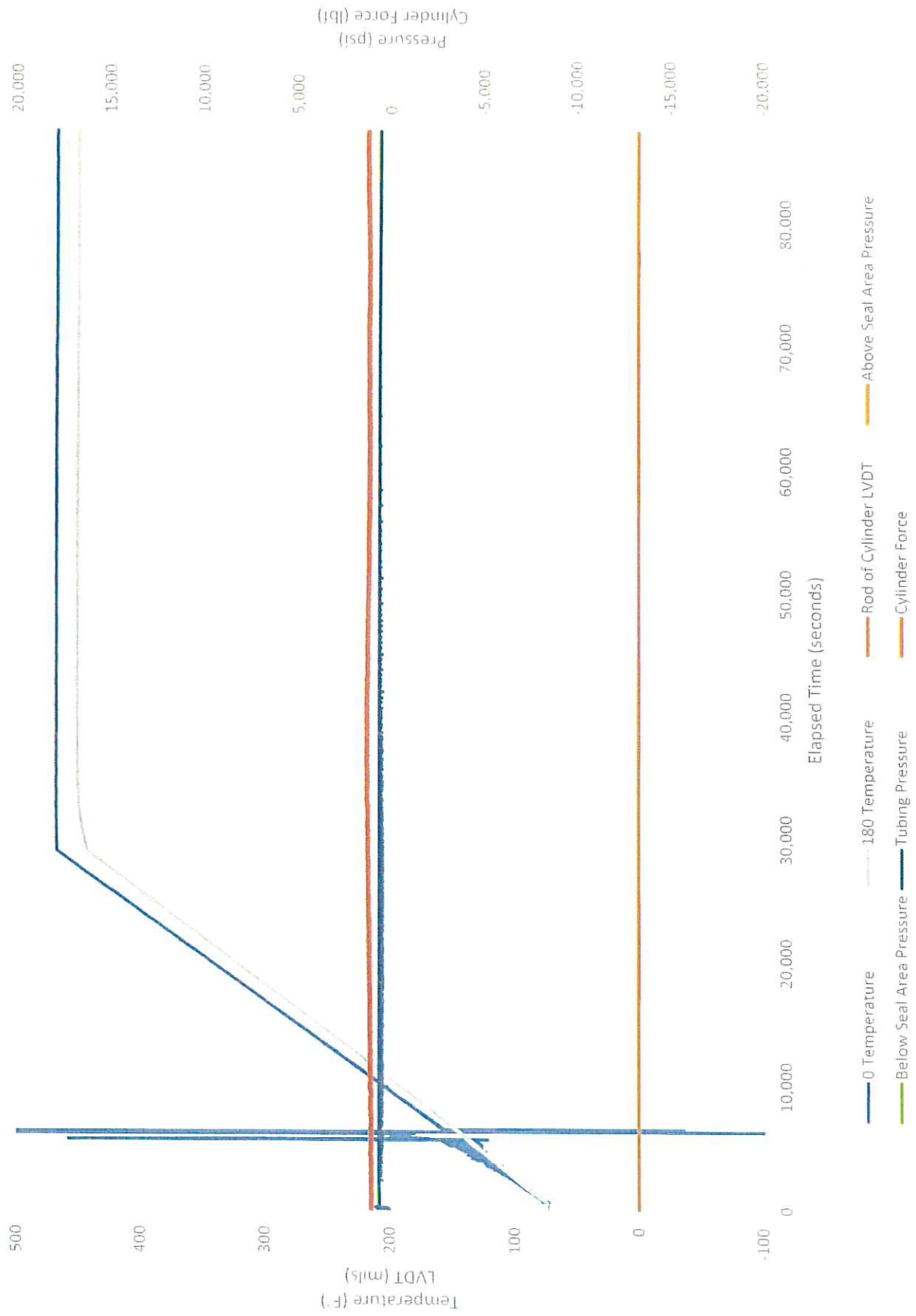
Page 2 of 2

5	Test Plots
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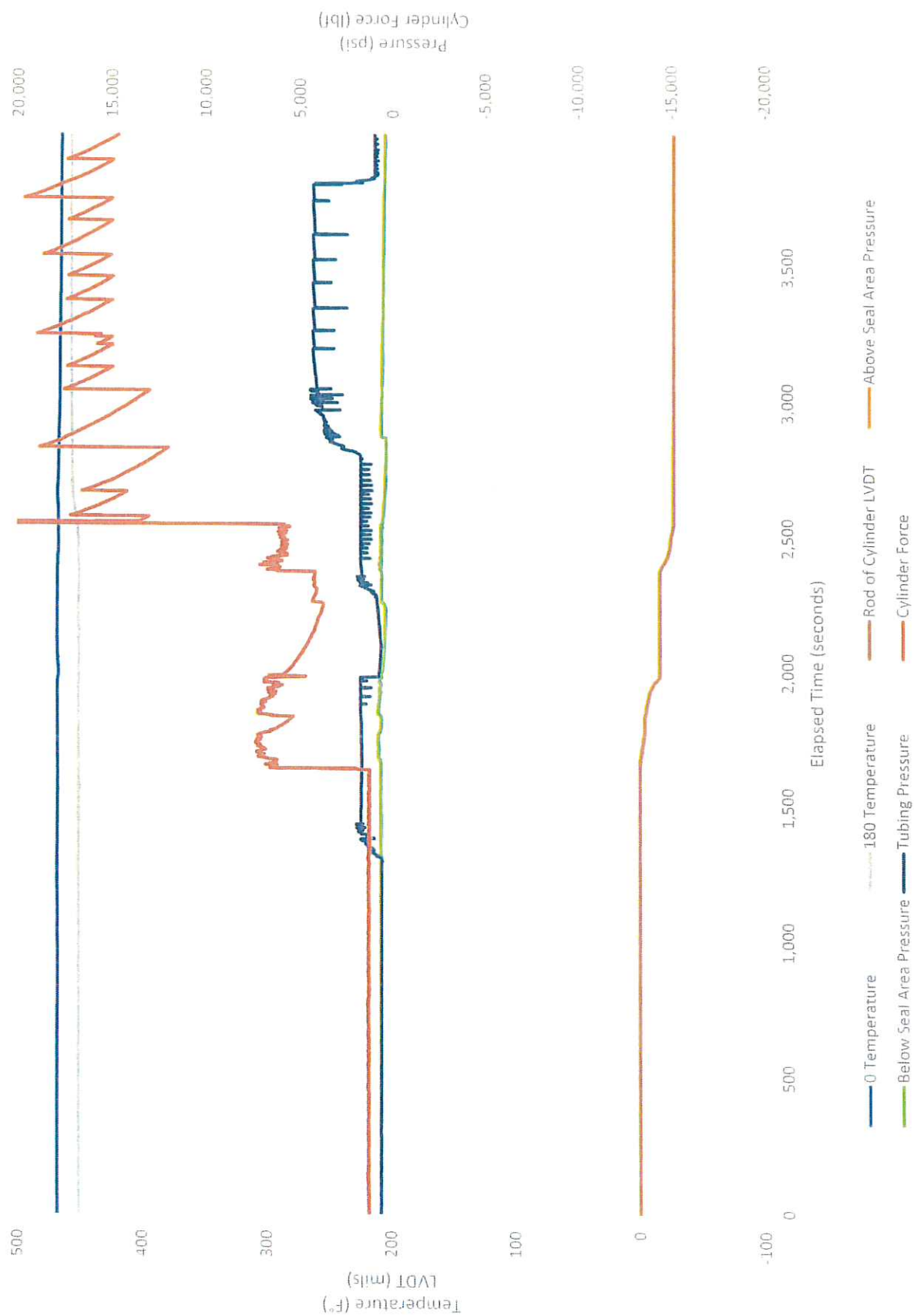
Graph 1



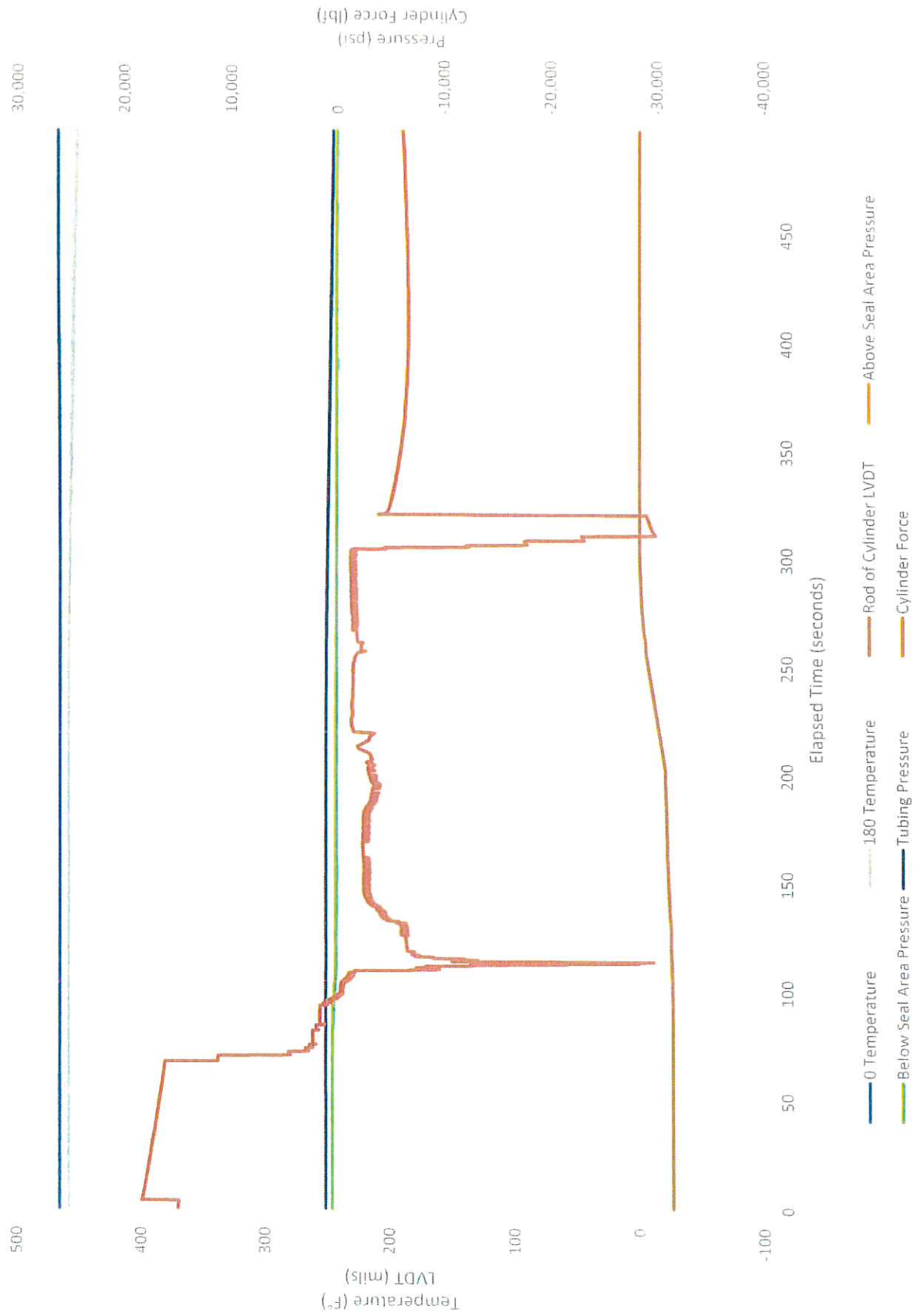
Graph 2



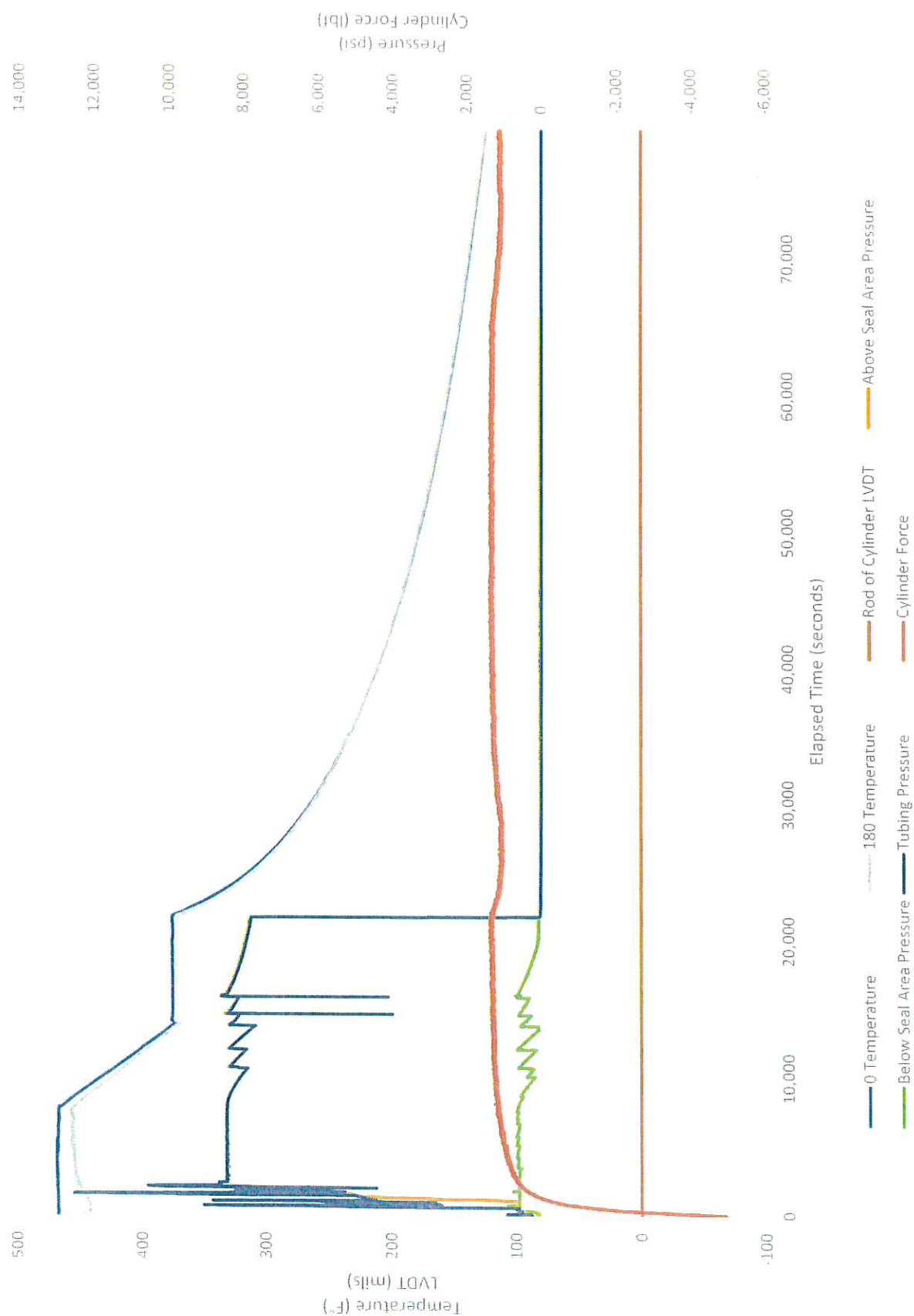
Graph 3



Graph 4



Graph 5



6	MTS Torque Graphs
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No MTS Torque Graphs

7	PetroQuip Torque Graphs
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No PetroQuip Torque Graphs

8	Operations Review
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Review No.		7002-22-2010-OR	
Project Information			
Customer:	PetroQuip	Date:	8/2/2023
MTS Project No.:	7002-22-2010	Project Manager:	Scott Wilson
Project Title:	Utah Forge Testing	Customer PO ^(select)	☐ YES ☐ NO
PO Received / PO Not Received			
Project Description	See attached Procedure		
Test Description			
Test Procedure Summary	See attached		
Temperature	Minimum:	Ambient	Maximum: 480
Pressure	Minimum:	0	Maximum: 10,000
Load	Minimum:	0	Maximum: 100 kips
Test Media	Liquid:	Duratherm HF	Gas: N/A
Required Data Collection	Load Displacement, Pressure, Temperature		
Required Equipment	Custom		
Electrical Safety	Check induction lines for damage, ground test article		
Required PPE	Standard		
Barrier Selection	PetroQuip Underground Bunker		
Stored Energy	E=	382,000 ft-lbs	E= N/A lbs of TNT
Max Pressure Ratings	Temperature	Pressure Circuit	Fittings
	Ambient	psi	psi
	Elevated	psi	psi
Technicians			
Hazard Assessment *Refer to Standing Job Hazard Analysis (JHA) Mitigation/Elimination Detail			
Environmental Hazards (Daily JSA)	Test Media Spill		
Operational Hazards (Daily JSA)	Potential for stored energy release. Exposure to compressed test media. Exposure to high temperature. Manual handling of loads. Fork life operation, pinch/crush hand/ legs		

Pre-Test Checks and Approvals		
Description	Verification	Comments
Adequate Illumination (lighting)	☐ YES ☐ NO	
Slip/Trip/Fall Hazards / JSA Initiated	☐ YES ☐ NO	
Organized Test Set-up	☐ YES ☐ NO	
Organized Work Area	☐ YES ☐ NO	
All Test Media Labeled	☐ YES ☐ NO	
All Pressure Line(s) Labeled	☐ YES ☐ NO	
Calibrated Equipment Verified & Current	☐ YES ☐ NO	
Sensors adequate for Test	☐ YES ☐ NO	
Test Specimen assembled per Customer requirements	☐ YES ☐ NO	
Test Specimen ports connected per pressure diagram	☐ YES ☐ NO	
Standing JHA / JSA Addendum Initiated	☐ YES ☐ NO	*Daily JSA is required

Operations Review Sign-Off	
Preliminary Sign-Off	Final Sign-Off
Technician: <u>Travis Nassar 8/4/23</u>	
Technician: <u>Evan McSorley 8/04/23</u>	
Technician: <u>Jason Lucas 8/4/23</u>	<u>Jason Lucas 8/4/23</u>
Customer: <u>Tracey Blanton 8/8/23</u>	
Customer:	
Project Manager: <u>Scott Wilson S.W. 8/2/23</u>	
Director of Completions:	
Other (Specify): <u>Debbie Wiscell Housley 08/08/23</u>	
<u>Mike Lee Johnson 08/08/23</u>	

Attachments (as applicable)	
Attachment 1	Detailed Test Procedure
Attachment 2	Test Media MSDS
Attachment 3	Test Layout, Assembly Drawings & Detailed Drawings of Fixtures
Attachment 4	Manufacturing Documents (MTR, WPS, PQR, Etc.)
Attachment 5	Stored Energy & Critical Component Analysis
Attachment 6	Test Article Serial Number Photo / traceability stamping (as applicable)
Attachment 7	Channel List (including calculated channels)

9	Meeting Sign in Sheets
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Meeting Description
Safety Meeting

Date
August 2, 2023

Meeting Leader:
Scott Wilson

Location:

Attendees

	Name	Role	Signature
1.	Scott Wilson	VP	Scott Wilson
2.	Travis Nassar	Tech	TS NR
3.	Euan McSorley	Tech	Euan McSorley
4.	Jason Lucas	Sr Tech	Jason Lucas
5.	Tracy Blanton	ENG	Tracy Blanton
6.	Bobby Wisczechuski	ops	Bobby Wisczechuski
7.	Lee Emerson	ops	Lee Emerson
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			

10	Health, Safety, Environmental Review
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Health Safety & Environmental		Document Name:	Daily Job Safety Analysis (JSA) Addendum
		Section:	HSE-8
Revision	3	Date	3/25/2022
		Document Number:	MTS-8-4-A

Date:	8/4/23	Work Area:	Test Bay #1
Description of Work Activity:			
Evacuation Routes Identified:	☒ Yes	☐ No	Muster Point:

APPLICABLE STANDING JOB HAZARD ANALYSIS (JHA) (check all that apply)			
☐ Crane Operations	☒ Forklift Operations	☒ Hydro Test Operations	☐ Install-Remove Rigging
☒ Overhead Crane Operations	☒ Test Specimen Preparation	☐ WHSE Issue & Receive Mat'l	☐ Welding-Hot Work

POTENTIAL HAZARDS (check all that apply)			
☒ Lifting Hazard, Muscle Strain	☒ Fire or Explosion Potential	☒ Potential Energy Release	☐ Hazardous Chemical Exposure
☒ Pinch, Crush, Strike Hazards	☒ Limited Access/Egress	☒ Low Light	☐ Open Holes, etc.
☒ Slips, Trips and Falls	☒ Line of Fire	☒ Travel Path Obstructions	☐ Traffic, Equipment Hazards
☒ Electrical Shock	☒ High Noise Level (≥ 90 db)	☐ Rotating Machinery	☒ Fall Hazards (6ft-greater)
☒ Overhead Hazards	☒ Hot / Cold Surfaces	☐ Severe Weather-High Winds	☒ Heat / Cold Stress
Other:			

SAFETY EQUIPMENT (check all that apply)			
☒ Hard Hats	☐ Nitrogen Monitor	☐ Barricades	☐ Whip Checks
☒ Safety Shoes (task appropriate)	☐ 4-Gas Monitor	☒ Ladder, Portable Stairway	☐ Jacks, Rollers, Dolly-Pallet Jack
☐ Safety Glasses	☐ Personal Gas Monitor	☐ Equip Guards (Tool-Machines)	☐ Environmental Health - SDS
☒ Gloves	☐ Face Shields / Goggles	☒ Absorbant Pads/Containment	
☐ Hearing Protection	☐ Flags / Air Horn	☐ Fall Protection	
☐ Respirator	☒ First Aid Kit	☒ Fire Extinguishers	
Other:			

APPLICABLE SAFE WORK PRACTICES (check all that apply)			
☒ Forklift/PID MTS-HSE-4-2	☒ Machine Guarding MTS-HSE-6-5	☐ Tool Safety MTS-HSE-3-15	☐ Rigging/Lifting MTS-HSE-3-13
☒ Housekeeping MTS-HSE-6-4	☒ Weld/Hot Work MTS-HSE-3-16	☒ First Aid/CPR MTS-HSE-2-2	☒ Fire Prevention MTS-HSE-3-7
☒ Use of PPE MTS-HSE-3-12	☒ Stop Work Auth. MTS-HSE-3-15	☒ Fall Protection MTS-HSE-3-6	☒ HAZCOM MTS-HSE-3-8
☒ Resp. Protection MTS-HSE-5-11	☒ Crane Operations MTS-HSE-3-3	☐ Gas Hazards MTS-HSE-5-6	☒ Barricades MTS-HSE-3-1
☒ Waste Manage MTS-HSE-6-4	☒ Material Handling MTS-HSE-3-11	☒ Ladder Safety MTS-HSE-3-9	☒ Hearing Con. MTS-HSE 5-7
Other:			

STANDING JHA DAILY ADDENDUM		
Additional Tasks, Steps or Tools	Potential Hazards	Mitigation/Elimination Steps
General Shop Work (Using electric and/or pneumatic tools, hand tools, band saw, jack stands, vice, etc.)	Lifting Hazards, Back/Muscle Strains	Lift with legs, never your back. Do not twist or overreach. Use additional manpower/device if over 50-lbs.
	Slip, Trip or Fall Hazards	Maintain good housekeeping practices and clear travel paths. Tie off or hold ladders. Maintain 3 points of contact on stairs & ladders. Run cords overhead if possible or red flag/tape down all chords.
	Line of Fire/Pinch Point Hazards	Maintain appropriate space in between employees utilizing hand tools etc. Inspect tools before use, use whip checks & face shield. Maintain proper hand position.
	Cut or Abrasions Hazards from Blades, Bits, Discs etc.	Unplug power tools to change disc, bits, blades, adjusting guards or when not in use. Hold tools with both hands on manufactures designed handles, do not remove handles/safety guards. Do not place hands on edges of material.
	Materials or Clothing Caught in Rotating Parts of Tools	Keep loose clothing tucked in and/or material secured and away from rotational parts of tools while in use. Have shirt sleeves buttoned.

Safety Data Sheet (SDS)

OSHA HazCom Standard 29 CFR 1910.1200(g), Rev. 2012 and GHS Rev 03

SECTION 1: Identification of the substance/mixture and of the company/undertaking

Product identifier

Product form: Mixture
Trade name: Duratherm HF
Product code: Duratherm HF
Recommended application: Heat Transfer Fluid

Details of the supplier of the safety data sheet

Duratherm
P.O Box 563, Lewiston, NY, 14092
Telephone: 1-905-984-6677
Qualified person's e-mail address: info@durathermfluids.com

Emergency telephone number:

Tel.: 1-905-984-6677

SECTION 2: Hazards identification

Classification of the substance or mixture

This substance is not classified according to the Globally Harmonized System (GHS)

Label elements

GHS label elements: Non-regulated material, no labeling elements
Hazard pictograms: Non-regulated material
Signal word: No single word, non-regulated material

Classification system

NFPA Rating: Health: 0, Fire:1, Reactivity:0
HMIS Rating: Health: 0, Fire:1, Reactivity:0

Other hazards

Other Hazards: None known

SECTION 3: Composition/information on ingredients

3.1 Substance

Not applicable

3.2 Mixture

Chemical Characterization: Mixture
Classification according to GHS: Not classified
Dangerous Components: None, non-regulated material

Component Name	Identification	Classification according to GHS	%
Hydrocarbon	CAS#: 8042-47-5	Not classified	90-95%
Proprietary Additives	Trade Secret	Not classified	5-10%

SECTION 4: First aid measures

Description of first aid measures

Inhalation: Supply person with fresh air and consult doctor according to symptoms.
Skin contact: Remove polluted, soaked clothing immediately, wash thoroughly with plenty of water and soap, in case of irritation of the skin (flare), consult a doctor.

Eye contact	Remove contact lenses. Wash thoroughly for several minutes using copious water. Seek medical help if necessary.
Ingestion	Rinse the mouth thoroughly with water. Do not induce vomiting. Consult doctor immediately.

Indication of any immediate medical attention and special treatment needed
Treat symptomatically

SECTION 5: Firefighting measures

Suitable extinguishing media:	Water jet spray/foam/CO2/dry extinguisher
Unsuitable extinguishing media:	High volume water jet

Special hazards arising from the substance or mixture
In case of fire the following can develop: Oxides of carbon, toxic gases

Advice for firefighters

In case of fire and/or explosion do not breathe fume use protective respirator with independent air supply. According to size of fire use full protection, if necessary. Cool container at risk with water. Dispose of contaminated extinction water according to official regulations.

SECTION 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures

Personal precautions protective equipment:	Not required
Environmental precautions:	If leakage occurs, dam spillage and resolve leaks as soon as possible. Prevent fluid from entering drainage systems. If fluid accidentally enters drainage system alert authorities

Methods and material for containment and cleaning up

Soak up with absorbent material (e.g. universal binding agent, oil-dry, sand, diatomaceous earth) and dispose in accordance with local regulations

Reference to other sections

See section 7 for information on safe handling, see Section 8 for information on personal protection equipment, see Section 13 for disposal information

SECTION 7: Handling and storage

In addition to information given in this section, relevant information can also be found in section 8 and 6.1.

Precautions for safe handling:	No special measures required
Information about protection against explosions or fires:	No special measures required
Requirements to be met by storerooms:	Store in a cool dry place
General guidelines:	Ensure good ventilation; avoid contact with eyes or skin

Notes on general hygiene measures at the workplace

General hygiene measures for the handling of chemicals are applicable
Wash hands before breaks and at end of work
Keep away from food, drink and animal feed
Remove contaminated clothing and protective equipment before entering areas in which food is consumed

SECTION 8: Exposure controls/personal protection

Control parameters

No further data; see Section 7

Exposure controls:

Appropriate engineering controls:	Contain with oil absorbing material (oil dry). Remove oil absorbing material and dispose lawfully
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Personal protective equipment:



Hand protection:	PVC, neoprene, or nitrile gloves. Gloves should be replaced immediately if damaged or worn
Eye protection:	Eye protection necessary where liquid could be splashed or sprayed
Materials for protective clothing:	PVC, neoprene, or nitrile gloves
Hand protection:	In case of repeated or prolonged contact wear gloves and use moisturizing skin cream
Respiratory protection:	Normally not required in areas with adequate ventilation. In areas with poor ventilation or in the case of likely misting use appropriate respiratory equipment
Environmental exposure controls:	See section 12
Consumer exposure controls:	PVC gloves. Neoprene or nitrile rubber gloves
Other:	Wash hands thoroughly after exposure. Do not eat drink or smoke during use. Wash contaminated clothing before use

SECTION 9: Physical and chemical properties

Information on basic physical and chemical properties

Physical state:	Liquid
Color:	Light yellow, clear
Odor:	Characteristic
Odor threshold:	Not determined
pH-value:	Not determined
Melting point/freezing point:	Not determined
Initial boiling point and boiling range:	>650°F (>343°C)
Flash Point ASTM D92 (COC):	>520°F (>271°C)
Evaporation Rate:	NA
Flammability (solid, gas)	NA
Lower explosive limit:	Not determined
Upper explosive limit:	Not determined
Density @ 20°C:	0.85-0.88 g/ml
Bulk density:	NA
Solubility(ies):	Not determined
Water solubility:	Insoluble
Partition coefficient (n-octanol/water)	Not determined
Auto-ignition temperature:	Not determined
Decomposition temperature:	Not determined
Viscosity:	103 cSt @ 40°C
Explosive properties	NA
Oxidizing properties:	Not determined

Other information

Miscibility:	Not determined
Fat solubility / solvent:	Not determined
Conductivity:	Not determined
Surface tension:	Not determined
Solvents content:	Not applicable

SECTION 10: Stability and reactivity

Reactivity:	Stable under normal conditions
Chemical Stability:	Stable under normal conditions
Possibility of hazardous reactions:	No dangerous reactions known
Conditions to avoid:	See section 7
Incompatible materials:	Strong oxidizing agents, acids
Hazardous decomposition products:	No dangerous decomposition products known

SECTION 11: Toxicological information

Possibly more information on health effects, see Section 2 (classification).

Acute toxicity: Not Classified

Duratherm HF					
Toxicity/effect	Endpoint	Value	Unit	Organism	Notes
Acute toxicity, by oral route:	LD50	>5000	mg/kg	Rat	
Acute toxicity, by dermal route:	LD50	>2000	mg/kg	Rat	
Acute toxicity, by inhalation:	LD50	>2500	mg/kg/4hr	Rat	

Skin corrosion/irritation: Not classified – Unlikely to cause harm to skin with brief contact, long term contact may cause dermatitis
 Serious eye damage/irritation: Not classified
 Respiratory or skin sensitization: Not classified
 Repeated dose toxicity: Not classified
 Germ cell mutagenicity: Not classified
 Carcinogenicity: Not classified
 Reproductive toxicity: Not classified
 Other information: No further information available

SECTION 12: Ecological information

Duratherm HF					
Toxicity/effect	Endpoint	Value	Unit	Organism	Notes
Toxicity to fish:	LD50	>100,000	mg/kg/96hr	Trout	
Toxicity to daphnia:					n.d.a.
Toxicity to algae:					n.d.a.
Persistence and degradability:					n.d.a.
Bio-accumulative potential:					n.d.a.
Mobility in soil:					n.d.a.
Results of PBT and vPvB assessment:					n.d.a.
Other adverse effects:					n.d.a.

SECTION 13: Disposal considerations

Waste treatment methods

For the substance / mixture / residual amounts

Soaked polluted cloths, paper or other organic materials represent a fire hazard and should be controlled, collected and disposed of

For contaminated packing material

Pay attention to local and national official regulations

Empty container completely.

Uncontaminated packaging can be recycled.

Dispose of packaging that cannot be cleaned in the same manner as the substance.

Do not perforate, cut up or weld un-cleaned container.

SECTION 14: Transport information

Transport statements

UN number

DOT, ADN, IMDG, IATA:

Non-regulated material

ADR:

Non-regulated material

UN proper shipping name:

DOT, ADR, ADN, IMDG, IATA:

Non-regulated material

Transport hazard class(es)



DOT, ADR, ADN, IMDG, IATA:	Non-regulated material
Packaging Group	
DOT, ADR, IMDG, IATA:	Non-regulated material
Environmental hazards	
Marine pollutant:	No
Special precautions for users:	None
Transport in bulk according to Annex II: of MARPOL 73/78 and IB Code UN "Model Regulation"	Not applicable

SECTION 15: Regulatory information

Safety, health and environmental regulations/legislation specific for the substance or mixture

SARA Hazards	No SARA Hazards
TSCA (Toxic Substances Control Act):	All chemical substances in this mixture are included on or are exempted from listing on the TSCA Inventory for Chemical Substances
Proposition 65	Based on available information this product does not contain any components or chemicals currently known to the State of California to cause cancer, birth defects or reproductive harm at levels which would be subject to Proposition 65

Please note that Section 3 of this document lists only the hazardous components required by the specific country or region hazard communication regulations. The chemical identifiers listed in Section 3 are used globally for hazard communication purposes and may not reflect those used for chemical inventory coverage in a particular country or region. The chemical inventory information given in Section 15 of this document applies to the product as a whole and should be used when evaluating inventory compliance.

The components of this product are reported in the following inventories:

DSL All components of this product are on the Canadian DSL
 AICIS On the inventory, or in compliance with the inventory
 NZIoC On the inventory, or in compliance with the inventory
 ENCS On the inventory, or in compliance with the inventory
 KECI On the inventory, or in compliance with the inventory
 PICCS On the inventory, or in compliance with the inventory
 IECSC On the inventory, or in compliance with the inventory
 TCSI On the inventory, or in compliance with the inventory
 US.TSCA On TSCA Inventory

Labeling requirements

GHS label elements	Non-regulated material
Hazard pictograms	Non-regulated material
Signal word	Non-regulated material

Labeling requirements

GHS label elements	Non-regulated material
Hazard pictograms	Non-regulated material
Signal word	Non-regulated material

SECTION 16: Other information

These details refer to the product as it is delivered.

The statements made here should describe the product with regard to the necessary safety precautions - they are not meant to guarantee definite characteristics - but they are based on our present up-to-date knowledge.

Any abbreviations and acronyms used in this document:

AC	Article Categories
acc., acc. to	according, according to

ADR	Accord européen relatif au transport international des marchandises Dangereuses par Route
Art., Art. no.	Article number
ATE	Acute Toxicity Estimate according to Regulation (EC) 1272/2008 (CLP)
BOD	Biochemical oxygen demand
CAS	Chemical Abstracts Service
CEC	Coordinating European Council for the Development of Performance Tests for Fuels, Lubricants
CLP	Classification, Labeling and Packaging (REGULATION (EC) No 1272/2008 on classification, labeling and packaging of substances and mixtures)
CTFA	Cosmetic, Toiletry, and Fragrance Association
e.g.	for example (abbreviation of Latin 'exempli gratia'), for instance
EC	European Community
ECHA	European Chemicals Agency
EEA	European Economic Area
EEC	European Economic Community
EINECS	European Inventory of Existing Commercial Chemical Substances
ELINCS	European List of Notified Chemical Substances
EN	European Norms
EPA	United States Environmental Protection Agency (United States of America)
ERC	Environmental Release Categories
ES	Exposure scenario
Fax.	Fax number
gen.	general
GHS	Globally Harmonized System of Classification and Labelling of Chemicals
HMIS	Hazardous Material Identification System
IARC	International Agency for Research on Cancer
IATA	International Air Transport Association
IBC	Intermediate Bulk Container
IBC (Code)	International Bulk Chemical (Code)
IC	Inhibitory concentration
LC	lethal concentration
LC50	lethal concentration 50 percent kill
LD50	Lethal Dose, 50% kill
n.a.	not applicable
n.av.	not available
n.c.	not checked
n.d.a.	no data available
NFPA	National Fire Protection Association
ppm	parts per million
UN RTDG	United Nations Recommendations on the Transport of Dangerous Goods
VOC	Volatile organic compounds
WHO	World Health Organization
wwt	wet weight

These statements were made by:
 Duratherm, P.O Box 563, Lewiston, NY, 14092, Tel.: 1-905-984-6677, info@durathermfluids.com

11	Equipment Calibration
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Dtech Calibration
16151 Cairnway Dr.
Suite# 100
Houston, TX 77084



ch 1
Certificate of Calibration

Certificate #: C-27191

Revision #: 2

Service Provided To

PETROQUIP
20520 STOKES ROAD
WALLER, TEXAS 77484

WO Number: WO-3817
PO Number: VERBAL
I.D.: PW-0217
Serial Number: UNKNOWN



Calibration Date	2/3/2023	Calibration Interval	1 YEARS
Issue Date	2/3/2023	Temperature	69 F
Manufacturer	GP:50	Relative Humidity	36.6 %
Model Number	1171	Location	IN HOUSE
Instrument Description	TRANSDUCER 0-25,000 PSI		
Specification			

Service Notes

Output @ 0 PSI (mA)

Nominal	Tolerance (-)	Tolerance (+)	As Found	As Left	V	Serial No.	Unc (µin)	Desc
4.000	3.950	4.050	4.010	4.010				

Output @ 5,000 PSI (mA)

Nominal	Tolerance (-)	Tolerance (+)	As Found	As Left	V	Serial No.	Unc (µin)	Desc
7.200	7.150	7.250	7.202	7.202				

Output @ 10,000 PSI (mA)

Nominal	Tolerance (-)	Tolerance (+)	As Found	As Left	V	Serial No.	Unc (µin)	Desc
10.400	10.350	10.450	10.401	10.401				

Output @ 15,000 PSI (mA)

Nominal	Tolerance (-)	Tolerance (+)	As Found	As Left	V	Serial No.	Unc (µin)	Desc
13.600	13.550	13.650	13.602	13.602				

Output @ 20,000 PSI (mA)

Nominal	Tolerance (-)	Tolerance (+)	As Found	As Left	V	Serial No.	Unc (µin)	Desc
16.800	16.750	16.850	16.799	16.799				

Output @ 25,000 PSI (mA)

Nominal	Tolerance (-)	Tolerance (+)	As Found	As Left	V	Serial No.	Unc (µin)	Desc
20.000	19.950	20.050	19.998	19.998				

Service Provided To

PETROQUIP
20520 STROKE ROAD
WALLER, TEXAS 77484

WO Number: WO-3817
PO Number: VERBAL
I.D.: PW-0217
Serial Number: UNKNOWN



We certify the equipment used for this calibration is traceable to NIST through one or more of the following numbers:

Last / Next Cal Dates:	Reference Standard ID#:
8/22/2022 8/22/2023	181202319 RHT20 TEMPERATURE/HUMIDITY DATALOGGER
7/25/2022 7/25/2023	27316290005 ADT 672 DIGITAL PRESSURE CALIBRATOR

The following procedures were used for the calibration of the instrument(s):

SOP 090 Rev. 0 CALIBRATION OF TRANSDUCERS OR TRANSMITTERS

Calibration Result: PASS

Next Calibration Date: **2/3/2024**

Calibrated By:

Eduardo B.

Title: LAB TECHNICIAN

Approved By:

Lindsey S.

Title: DOCUMENT CONTROL

This certificate is not valid unless all page(s) are present:

Instrument(s) described in this certificate were calibrated using equipment traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes (NMI), or accepted fundamental constants, or by the use of specified methods, or consensus standards.

DTech's calibration methods have been audited and been found in compliance with ISO/IEC 17025:2017. Accredited calibrations are performed within the lab's scope of accreditation. These are indicated by the presence of the Accrediting Body's Logo and Certificate Number. Any measurands on an accredited calibration not covered by the lab's scope of accreditation do not have uncertainties values present.

The determination of compliance only applies to the specific instrument referenced above based on tolerances shown; these tolerances are either the original instrument's manufacturer (OEM) warranted specifications, a national/international recognized standard or the client's requested specifications.

The calibration was performed at 68 Fahrenheit +/- 2°, ≤55% RH unless otherwise specified in the comments section. Any number of factors may cause an instrument to drift out of tolerance at any time post its calibration.

The reported expanded uncertainty of measurement is stated as the combined standard uncertainty of measurement multiplied by the coverage factor k (k=2) such that the coverage probability corresponds to approximately 95%.

Dtech Calibration
16151 Cairway Dr.
Suite# 100
Houston, TX 77084



Certificate of Calibration

Certificate #: C-27192

Revision #: 2

Service Provided To

PETROQUIP
20520 STOKES ROAD
WALLER, TEXAS 77484

WO Number: WO-3817
PO Number: VERBAL
I.D.: PW-0218
Serial Number: UNKNOWN



Calibration Date	2/3/2023	Calibration Interval	1 YEARS
Issue Date	2/3/2023	Temperature	69 F
Manufacturer	GP:50	Relative Humidity	36.6 %
Model Number	1171	Location	IN HOUSE
Instrument Description	TRANSDUCER 0-25,000 PSI		
Specification			

Service Notes

Output @ 0 PSI (mA)

Nominal	Tolerance (-)	Tolerance (+)	As Found	As Left	V	Serial No.	Unc (µin)	Desc
4.000	3.950	4.050	4.006	4.006				

Output @ 5,000 PSI (mA)

Nominal	Tolerance (-)	Tolerance (+)	As Found	As Left	V	Serial No.	Unc (µin)	Desc
7.200	7.150	7.250	7.196	7.196				

Output @ 10,000 PSI (mA)

Nominal	Tolerance (-)	Tolerance (+)	As Found	As Left	V	Serial No.	Unc (µin)	Desc
10.400	10.350	10.450	10.396	10.396				

Output @ 15,000 PSI (mA)

Nominal	Tolerance (-)	Tolerance (+)	As Found	As Left	V	Serial No.	Unc (µin)	Desc
13.600	13.550	13.650	13.594	13.594				

Output @ 20,000 PSI (mA)

Nominal	Tolerance (-)	Tolerance (+)	As Found	As Left	V	Serial No.	Unc (µin)	Desc
16.800	16.750	16.850	16.794	16.794				

Output @ 25,000 PSI (mA)

Nominal	Tolerance (-)	Tolerance (+)	As Found	As Left	V	Serial No.	Unc (µin)	Desc
20.000	19.950	20.050	19.991	19.991				

Service Provided To

PETROQUIP
20520 STOKES ROAD
WALLER, TEXAS 77484

WO Number: WO-3817
PO Number: VERBAL
I.D.: PW-0218
Serial Number: UNKNOWN



We certify the equipment used for this calibration is traceable to NIST through one or more of the following numbers:

Last / Next Cal Dates:	Reference Standard ID#:
8/22/2022 8/22/2023	181202319 RHT20 TEMPERATURE/HUMIDITY DATALOGGER
7/25/2022 7/25/2023	27316290005 ADT 672 DIGITAL PRESSURE CALIBRATOR

The following procedures were used for the calibration of the instrument(s):

SOP 090 Rev. 0 CALIBRATION OF TRANSDUCERS OR TRANSMITTERS

Calibration Result: PASS

Next Calibration Date: **2/3/2024**

Calibrated By:

Eduardo B.

Title: LAB TECHNICIAN

Approved By:

Lindsey S.

Title: DOCUMENT CONTROL

This certificate is not valid unless all page(s) are present:

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DTech's calibration methods have been audited and been found in compliance with ISO/IEC 17025:2017. Accredited calibrations are performed within the lab's scope of accreditation. These are indicated by the presence of the Accrediting Body's Logo and Certificate Number. Any measurands on an accredited calibration not covered by the lab's scope of accreditation do not have uncertainty values present.

The determination of compliance only applies to the specific instrument referenced above based on tolerances shown; these tolerances are either the original instrument's manufacturer (OEM) warranted specifications, a national/international recognized standard or the client's requested specifications.

The calibration was performed at 68 Fahrenheit +/- 2°, ≤55% RH unless otherwise specified in the comments section. Any number of factors may cause an instrument to drift out of tolerance at any time post its calibration.

The reported expanded uncertainty of measurement is stated as the combined standard uncertainty of measurement multiplied by the coverage factor k (k=2) such that the coverage probability corresponds to approximately 95%.



Specialloy
11702 Brittmoore Park
Houston, Texas 77041
[713] 827-7776

Certificate of Calibration

Certificate No. 10021008 Transmitter RESULTS: PASS Print Date 6/29/2023

Unit Under Test(UUT)

UUT ID: 16199RW-124
Model: 1250
Range: 10-255.0mPa
Resolution: 0.001mPa
Application Site: Specialloy Calibration Laboratory
Accuracy: ±0.01%

Calibration Date: 6/29/2023
Expiration Date: 06/30/2024
Manufacturer: OTC
Customer: MFG

Calibration Results

	Result	Max Error	Temperature	Humidity	Atmospheric pressure
As Found	±0.01%	±0.01%	73°F	41%	14.44Psi
As Left	±0.01%	±0.01%	73°F	41%	14.44Psi

Calibration Data - As Found

SelfPoints	Reference	Nominal	Reference	Tolerance	Deviation	Error
psi	psi	mA	mA	mA	mA	(%)
0.0	0.0	4.0	3.9950	0.005	0.0050	-0.01
6250.0	6250.0	8.0	7.9972	0.008	0.0028	-0.02
12500.0	12500.0	12.0	11.9957	0.008	0.0043	-0.03
18750.0	18750.0	16.0	15.9963	0.006	0.0037	-0.02
25000.0	25000.0	20.0	20.0000	0.008	0.0000	0.00
31250.0	31250.0	24.0	23.9993	0.008	0.0007	-0.01
37500.0	37500.0	28.0	27.9993	0.008	0.0007	-0.01
43750.0	43750.0	32.0	31.9993	0.008	0.0007	-0.01
50000.0	50000.0	36.0	35.9997	0.008	0.0003	-0.01
56250.0	56250.0	40.0	39.9921	0.008	0.0079	-0.02

*** As Found Calibration Data Ends ***

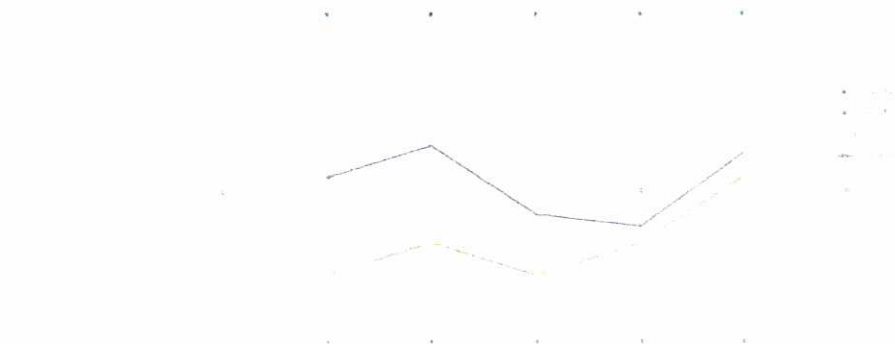
Calibration Data - As Left

SelfPoints	Reference	Nominal	Reference	Tolerance	Deviation	Error	BFSI
psi	psi	mA	mA	mA	mA	(%)	
0.0	0.0	4.0	3.9950	0.005	-0.0050	-0.13	1.9950
6250.0	6250.0	8.0	7.9972	0.008	-0.0028	-0.22	1.9980
12500.0	12500.0	12.0	11.9957	0.008	-0.0043	-0.33	11.9973
18750.0	18750.0	16.0	15.9963	0.008	-0.0037	-0.70	15.9981
25000.0	25000.0	20.0	20.0000	0.008	0.0000	0.00	19.9999
31250.0	31250.0	24.0	23.9993	0.008	-0.0007	-0.00	23.9991
37500.0	37500.0	28.0	27.9993	0.008	-0.0007	-0.00	27.9991
43750.0	43750.0	32.0	31.9993	0.008	-0.0007	-0.00	31.9991
50000.0	50000.0	36.0	35.9997	0.008	-0.0003	-0.00	35.9991
56250.0	56250.0	40.0	39.9921	0.008	-0.0079	-0.70	39.9921

*** As Left Calibration Data Ends ***

References

Manufacturer	Model	Serial Number	Certificate No	Due Date	Accuracy	BFSI ERROR
Adair Corporation	ADT251-30Y	011119610006	29340	6/29/2024	±0.01%	-0.015
Adair Corporation	ADT222A	3112415910005	317242	7/11/2023	±0.01%	-0.015
Adair Corp	ADT21M	01125	18410281	6/11/2024	±0.01%	-0.015



Signature

By: [Signature] Date: 6/29/2023
Specialloy Calibration Laboratory, 11702 Brittmoore Park, Houston, Texas 77041
Phone: (713) 827-7776, Fax: (713) 827-7777, Email: info@specialloy.com, Website: www.specialloy.com



Specialloy
11702 Brattmoore Park
Houston, Texas 77043
(713) 827-7776

Certificate of Calibration

Transmitter

Certificate No. 061319
Unit Under Test (UUT)
UUT ID: ADP2915A-024
Model: GP-50
Range: 0-2500psi
Resolution: 0.01psi
Application Site: Spectroscopy & Petrochemical Refining
Accuracy: $\pm 0.01\%$
Calibration Date: 8/24/2024
Expiration Date: 8/24/2025
Manufacturer: GP-50
Customer: NPT
RESULTS: PASS
Print Date: 8/24/2024

Calibration Results

	Result	Max Error	Temperature	Humidity	Atmospheric pressure
As Found	0.0000	0.0000	70°F	45%	1014.4 Pa
As Left	0.0000	0.0000	70°F	45%	1014.4 Pa

Calibration Data - As Found

SetPoints	Reference	Nominal	Reference	Tolerance	Deviation	Error
psi	psi	mA	mA	mA	mA	(%)
0.0	0.0	3.9994	4.0000	0.0006	0.0006	0.01
6250.0	6250.0	7.9910	7.9984	0.0074	0.0074	0.01
12500.0	12498.0	11.9987	11.9989	0.0002	0.0002	0.00
18750.0	18743.0	15.9955	15.9953	0.0002	0.0002	0.00
25000.0	24979.0	19.9886	20.0161	0.0275	0.0275	0.14
18750.0	18762.0	16.0070	16.0108	0.0038	0.0038	0.02
12500.0	12517.0	12.0108	12.0052	0.0056	0.0057	0.04
6250.0	6262.0	8.0017	8.0029	0.0012	0.0012	0.01
0.0	0.0	4.0000	4.0000	0.0000	0.0000	0.00

As Found Calibration Data End Here

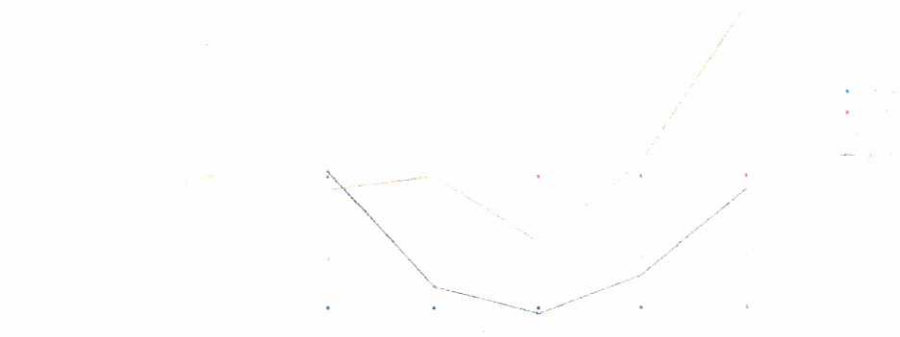
Calibration Data - As Left

Test Point	Limit	Limit	SetPoints	Reference	Nominal	Reference	Tolerance	Deviation	Error
	Max	Min	psi	psi	mA	mA	mA	mA	(%)
1	-0.01	0.01	0.0	0.0	3.9994	4.0000	0.0006	0.0006	0.01
2	0.00	0.02	6250.0	6234.0	7.9910	7.9984	0.0074	0.0074	0.01
3	0.00	0.02	12500.0	12498.0	11.9987	11.9989	0.0002	0.0002	0.00
4	0.00	0.02	18750.0	18743.0	15.9955	15.9953	0.0002	0.0002	0.00
5	0.00	0.01	25000.0	24979.0	19.9886	20.0161	0.0275	0.0275	0.14
6	0.00	0.02	18750.0	18762.0	16.0070	16.0108	0.0038	0.0038	0.02
7	0.00	0.02	12500.0	12517.0	12.0108	12.0052	0.0056	0.0057	0.04
8	0.00	0.02	6250.0	6262.0	8.0017	8.0029	0.0012	0.0012	0.01
9	0.00	0.02	0.0	0.0	4.0000	4.0000	0.0000	0.0000	0.00

As Left Calibration Data End Here

References

Manufacturer	Model	Serial Number	Certificate No.	Due Date	Accuracy	BFSI ERROR: 0.054
AquaG Corporation	ADP2915-GP50-PS15	2114292610017	061319	8/24/2024	0.05%	
AquaG Corporation	ADP299	2114292610019	061319	8/24/2024	0.05%	
AquaG Corporation	ADP2915	2114292610018	061319	8/24/2024	0.05%	



[Signature]
Specialloy
11702 Brattmoore Park
Houston, Texas 77043
(713) 827-7776